



Investigating the Effective Factors on Learning Mathematical Concepts in Pre-School Students of 1st District of Zahedan in the Academic Year 2013-2014

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Received: 10 Jan 2015

Revised: 21 Feb 2015

Accepted: 27 Mar 2015

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ABSTRACT

The aim of the present study is to investigate the effective factors on learning mathematical concepts in pre-school students in 1st district in of Zahedan. This research is a correlation survey-descriptive study. The statistical population includes all trainers and pupils of pre-schools of 1st district of Hamedan which was totally estimated as 87 trainers and 1486 pupils. Regarding Morgan Table, the volume of sample included 70 trainers and 300 pupils through random selection. The data were collected using Inventory of teaching mathematical concepts and inventory of mathematical concepts which were prepared based on the previous research and guidance of the advisory professor of researcher. The reliability coefficient of Cronbach's Alpha was estimated 0.91 for inventory of teaching mathematical concepts and 0.87 for the inventory of mathematical concepts. The data are analyzed by statistical indices such as Pearson correlation and one-way variance analysis. The results indicate that: the training method of trainers, using educational equipment, academic degree, the experience of trainers of pre-school, parents' educational, professional and financial status are among the effective factors on increasing the learning of mathematical concepts by pre-school students.

Keywords: active teaching, discovery, plays and educational-aids.



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INTRODUCTION

Pre-school is a sensitive period of growing learning. Since education takes place easier, deeper and faster during this period much significance is put on it. Teaching mathematical concepts like other subjects has been emphasized by psychologists and education experts and theorists such as Pestalozzi, Froebel, and Montessori include it in their education program. The studies of contemporary psychologist, Piaget has also demonstrated the effect of mathematics teaching in cognitive growth of children by experimental methods. Teaching mathematical concepts not only helps the mental growth of children in the early years of childhood but studies show that it also has effects on their adulthood and prepares them for learning mathematical concepts in primary school and higher grades. Teaching of mathematics is also effective in the routine works of children such as identifying and moving toys, the amount of food, counting money, etc. and mathematical concepts help the child to develop principle features such as mind order, detail and focus, analysis and resolution, reasoning, etc.

The concept of education in the pre-school period mostly relies on the experience of student in the kindergarten and pre-school period. The recent studies about child growth and primary educations demonstrate the fact that there is not a proper definition of education in the early years yet. Child psychologists often distinguish between infancy, early childhood and later childhood of a child's life. When discussing the growth and development of children, distinction and classification of periods are justified. Some researchers define the early childhood based on age. For example from 1 year up to 6 years or from 2 up to 5 years or even 2-3 years up to 8 years are such classifications. It is said that the early childhood starts when the child can walk independently and regarding the fact that a new horizon opens up by this ability, this period is suitable for curiosity, learning and educating for the child [1].

Nowadays, regarding the ceaseless concept of education, the discussion concerning learning in the early childhood has been developed both quantitatively and qualitatively. The pre-school education is defined as: the education which starts at birth and continues up to the first years of primary school i.e. at the end of six years old [2]. In the early childhood, the child shows the highest degree of development in learning concepts. In this period, basic concepts are learnt actively and children develop from pre-operational level to the operational and objective levels [3].

The mathematical experiences which constitute an important part of life is recognized in the form of long difficult processes. Children encounter with mathematical concepts in the very beginning of their childhood. It is first transferred through playing with objects and toys. As a result, in order to develop mathematical concepts energetic and specific methods seems necessary for the child. Many studies show that the information which is obtained by child in a dynamic learning environment is registered and retained in her mind [4]. Moreover, using objective instruments especially in the primary school and kindergarten considerably increases the success of students in mathematics. The mathematical concepts which students will use in their future are basically learnt in the first years of childhood. They learn these concepts first physically then mentally and few people finally learn through the experience of interaction with the environment. Many concepts exist in the mathematics which are learnt by the child in different stages of learning such as basic concepts of numbers like counting, adding and subtracting, dividing and other concepts such as shapes, weight and volume, length and width, etc. teaching mathematics must be continuous; for example in order to teach simple adding first numbers and their use must be taught.

One of the main concerns of most theorists and programmers of pre-school education is the way children realize mathematical concepts and relations. Mathematics includes the study of relations but this is almost difficult for a child. A child needs to understand how things are related to each other. We take family relationship as an example: brothers, sisters, father, mother, aunt and the like. 1 and 2 by using less than relationship, i.e. 1 is less than 2 are related. During the sessions of adults' discussions and plays, children start to realize this relationship. Games are also give opportunity to learn an extensive range of mathematics terms such as above, under, next, on, beside, etc. on the



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other hand, many recent discussions have addressed the issue of obtaining numerical skills by children. In general, it is accepted that children need to experience in the fields of calculation, sorting, grouping and comparing in order to learn numerical concepts. Piaget believes that children have to understand one to one correspondence before they can realize mathematical operations. It means that they learn gradually how to sort two group of objects **together** (a fork and a knife), but they do not yet understand the concept of equal number of knife and fork and this concept i.e. equality is meaningful to them in particular ways [5].

Regarding the importance of teaching mathematical concepts in the pre-school period, the effective role of mathematics in individual growth and social development, and also in preparing children to learn mathematical concepts requires more and better researches regarding recognition of tools, methods and techniques of teaching mathematics, applying them and the effective factors on learning mathematics concepts in this period. To this aim the researcher here attempts to investigate the condition of education and learning mathematical concepts in pre-school period and the factors which affect it, and provides some suggestions.

RESEARCH METHODOLOGY

Regarding the nature and objectives of the research, i.e. investigating the effective factors on learning mathematical concepts in children of pre-school; the research uses a descriptive, survey method with correlation.

Statistical Population, Sample and Sampling Method: The statistical population of this study included all trainers and pupils of pre-schools of district 1 of Zahedan city. The population included 87 trainers and 1486 students. Using Morgan Table, the sample volume contains 70 trainers and 300 students selected randomly.

Measurement Instrument and Its Application: The measuring instruments of the research are two inventories as explained in the following:

Inventory of teaching mathematical concepts

This inventory is prepared based on studying the related literature of research and guidance of advisory professor. The formal validity of inventory is confirmed by advisory professor, consultant and experts of education management and psychology. It includes 28 questions and four variables. The reliability of questionnaire was obtained using Cronbach's alpha coefficient as 0.91. The number of questions and the reliability coefficient of questionnaire variables are presented in Table 1. The inventory is regulated according to Table 2 on a 5 score rating scale.

The inventory of mathematical concepts

This inventory of mathematical concepts is prepared based on the related literature of research and guidance of advisory professor. The formal validity of inventory is confirmed by advisory professor, consultant and experts of education management and psychology. It includes 18 questions and 3 variables. The reliability of questionnaire was obtained using Cronbach's alpha coefficient as 0.87. The number of questions and the reliability coefficient of questionnaire variables are presented in Table 3. The inventory of mathematical concepts is scored on a binary scale (True or False).



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DATA ANALYSIS

In this step, data are analyzed using statistical tests: descriptive and analytic (Pearson correlation and one way variance) using software package of social sciences.

Question 1: Is there any significant relationship between educational methods and learning mathematical concepts in the pre-school period?

In order to investigate the relationship between educational methods and learning mathematical concepts, Pearson correlation coefficient is used and results are obtained as presented in Table 4. The result of Table 4 indicates that there is a positive meaningful relationship between educational methods and learning mathematical concepts at the level of 99%. ($r=0.45$, $p \leq 0.01$). Moreover, a positive relationship was found between game teaching method and learning mathematical concepts at the level of 99% ($r=0.42$, $p \leq 0.01$). There is also a positive meaningful relationship between discovery teaching method and learning mathematical concepts at the level of 99% ($r=0.34$, $p \leq 0.01$). As a result, in statistical terms it can be said that there is a meaningful relationship between teaching methods and learning concepts in pre-school period.

Question 2: Is there any meaningful relationship between educational aids and learning mathematical concepts in pre-school students?

In order to investigate the relationship between using educational aids and learning mathematical concepts, Pearson correlation coefficient is used. The result is presented in Table 5. Table 5 demonstrates that the relationship between using educational aids and learning mathematical concepts is positive and significant at the level of 99 percent ($p \leq 0.01$, $r=0.31$). Hence, it can be said statistically that when trainers use more educational aids learning of mathematical concepts in pre-school increases.

Question 3: Is there any meaningful relationship between academic degree and the experience of pre-school trainers with learning mathematical concepts in pre-school students?

In order to investigate the difference between academic degree and degree of experience of pre-school trainers with learning mathematical concepts of pre-school students, one-way analysis of variance is used and the result is presented in Table 6. The results of Table 6 indicate that there is a significant difference between the means of learning mathematical concepts in pre-school students regarding the academic degree of pre-school trainers at the level of 99% ($F=5.43$, $p < 0.01$). Hence, according to the statistics, it can be said that as the level of education of pre-school trainers goes higher the level of learning mathematical concepts in the student increases.

The results of Table 7 indicate that there is a significant difference between the means of learning mathematical concepts in pre-school students regarding the experience of pre-school trainers at the level of 99% ($F=6.39$, $p < 0.01$). Hence, according to the statistics, it can be said that as the experience of pre-school trainers increases the level of learning mathematical concepts in the student increases too.

Question 4: Is there any significant relationship between education, professional and financial status of parents and learning mathematical concepts in pre-school students?

In order to investigate the difference between educational, professional and financial status of parents with learning mathematical concepts of pre-school students, one-way analysis of variance is used and the results are presented in Table 8. The results shown in Table 8 demonstrated that there is a significant difference between mean of learning mathematical concepts in pre-schools students regarding father's education at the level of 99% ($F=6.93$, $p < 0.01$) and



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mother's education at the level of 99% ($F=5.87$, $p<0.01$). Statistically, it can be said that as the level of parents' education goes higher, the learning of mathematical concepts increases in pre-school students.

The results of Table 9 shows that the difference between means of learning mathematical concepts regarding the father's job in pre-school children is at the level of 99% ($F=7.43$, $p<0.01$). As the highest mean (27.28) is related to academics fathers and the lowest mean (23.24) belongs to fathers in "others" category of jobs. Also, The results of Table 9 shows that the difference between means of learning mathematical concepts regarding the mother's job in pre-school children is at the level of 99% ($F=4.87$, $p<0.01$). As the highest mean (27.28) is related to academics mothers and the lowest mean (23.24) belongs to officer mothers. Table 10 represents that the difference between means of learning mathematical concepts regarding parents' income in pre-school children is at the level of 99% ($F=7.43$, $p<0.01$). As the highest mean (28.24) is related to high income parents and the lowest mean (20.34) belongs to low income parents.

DISCUSSION AND CONCLUSION

Question 1: Regarding the first research question it was found that a significant positive relationship exists between educational methods of teaching and learning mathematical concepts. The highest significance belongs to game-based teaching method and the lowest significance belongs to discovery training. This finding is consistent with the previous research: Teimuri [4] found that learning increases in the students who were taught using educational toys. Saneh and Salman [5] demonstrated that using organized educational games can accelerate learning concepts such as quantity, distance, shape, and different directions in pre-school students. Young Loveridge [6] showed that a children educational program which include story, music and plays, considerably increases learning of mathematic knowledge.

Question 2: According to the findings of the study related to 2nd research question, a positive significant relationship was found between using educational aids and learning mathematical concepts. This finding is consistent with: Teimuri [4] found that learning improved in students who were taught by educational toys and aids. Salman [7] conducted a research on investigating the effect of physical activities and games in mental evolution of pre-school students. He found that the degree of evolution is more in children who were engaged in games and activities than those who were not.

Question 3: The findings related to this question indicate that as the level of education and experience of pre-school trainers goes higher, learning mathematical concepts increases in pre-school students.

Question 4: The results answering the above question indicate that as the level of parents' education goes higher, the amount of learning mathematical concepts in pre-school students also increases. Moreover, the mean of learning mathematical concepts in pre-school students with respect to father's job and mother's job is varied (the highest mean belongs to fathers with academic job and the lowest mean belongs to "other" jobs category. And the highest mean is related to academics mothers and the lowest mean belongs to officer mothers). Regarding the income of parents, a significant difference was observed. The highest mean is related to high income parents and the lowest mean belongs to low income parents. This finding is consistent with findings of Pahlavan Sadegh et al. [8], who found that the socio-economic status of family has considerable direct effects on mathematics progress. Farshad [9] showed that students belonging to higher classes have more educational progress compared to students of middle and lower class. Tashakori et al. [10] demonstrated that effectiveness of pre-school programs on children who have literate fathers is higher and as the level of education goes higher the effect increases too; on the other hand, it is also consistent with this finding that in the groups which belong to higher social classes, the effect of pre-school programs was weaker than children of other classes. Thus, it can be concluded that discovering the factors which are effective on the progress of learning mathematical concepts of pre-school education centers is very important. The findings of present research showed that the teaching method, using educational aids and instruments, the academic degree and experience of pre-school trainers, education, occupation and financial status of parents are among the effective factors which increase learning mathematical concepts in pre-school students. It is concluded that in active learning methods





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such as games and discovering methods, a child-oriented free learning environment and autonomy is created for the children and enables them to express their ideas and themselves. Children experience more activities in this process and learn more concepts while enjoying the games. Regarding the fact that many believe mathematics to be an abstract hard-to-learn subject, an active method of teaching especially game-based methods will turn it to an enjoyable activity for children.

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Table 1: The number of questions and the reliability coefficient of Inventory of teaching mathematical concepts

Variable	The number of question	The reliability coefficient
Active method	1-7	0.80
Discovery teaching	8-17	0.85
Game	18-22	0.90
Using educational aid-tools	23-28	0.85
total	28	0.91

Table 2. Scoring of inventory of teaching mathematical concepts

1	2	3	4	5
Very low	Low	Medium	Large	Very large





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Table 3: The variables and the reliability coefficient of Inventory of mathematical concepts

Variable	The question number	The reliability coefficient
Classifying	1-5	0.80
Aligning	6-10	0.78
One to one correspondence	11-18	0.79
Total	18	0.87

Table 4: The relationship between educational methods and learning mathematical concepts

Variables		Learning mathematical concepts
Active	Correlation coefficient	0.39
	Level of significance	0.00
Game	Correlation coefficient	0.42
	Level of significance	0.00
Discovery	Correlation coefficient	0.34
	Level of significance	0.00
Educational methods	Correlation coefficient	0.45
	Level of significance	0.00

Table 5: The relationship between using educational aids and learning mathematical concepts

Variables		Learning mathematical concepts
Using educational aids	Correlation coefficient	0.31
	Level of significance	0.00

Table 6: The difference in learning mathematical concepts in pre-school children regarding the academic degree of trainers

Variable	Academic degree	No.	Mean	SD	Degree of freedom	F	Sig.
Academic degree	Diploma	32	20.22	1.01	267	5.43	0.01
	Associate degree	25	23.38	0.86			
	Bachelor's degree	13	27.56	0.75			





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Table 7: The difference in learning mathematical concepts of pre-school students regarding the experience of trainers

Variable	Experience	No.	Mean	SD	Degree of freedom	F	Sig.
Experience	Under 5 years	38	22.13	1.67	267	6.39	0.01
	5-10 years	12	25.17	0.94			
	Over 5 years	20	29.16	0.84			

Table 8: The difference in learning mathematical concepts of pre-school students regarding parents' level of education

Variable	Academic degree	No.	Mean	SD	Degree of freedom	F	Sig.
Father	Under-diploma	83	22.31	1.23	3	6.93	0.01
	Diploma	88	24.54	1.10	296		
	Associate degree	76	27.67	0.98			
	Bachelor's degree	53	29.76	0.85			
Mother	Under-diploma	28	19.12	1.20	3	5.87	0.01
	Diploma	139	21.14	1.07	296		
	Associate degree	94	24.34	0.95			
	Bachelor's degree	39	26.56	0.83			

Table 9: The difference in learning mathematical concepts of pre-school students regarding parents' occupation

Variable	Occupation	No.	Mean	SD	Degree of freedom	F	Sig.
Father	Officer	90	26.14	0.83	2	7/43	0.01
	academic	87	28.78	0.75	296		
	others	122	23.24	0.96			
Mother	officer	84	25.34	0.93	2	4/87	0.01
	Academic	77	29.56	0.72	296		
	housewife	139	27.32	0.74			

Table 10: The difference in learning mathematical concepts regarding parents' income in pre-school children

Income	No.	Mean	SD	Degree of freedom	F	Sig.
Low	97	20.34	0.83	3	7.09	0.01
Medium	159	25.18	0.75	296		
High	44	28.24	0.96			





RESEARCH ARTICLE

Taking Possession of Lands by Municipality from Viewpoint of Jurisprudence and Law

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Received: 14 Mar 2015

Revised: 23 Apr 2015

Accepted: 28 May 2015

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ABSTRACT

Ownership rights at first place belong to individuals and it attracts attentions as most important issue in the area of implementing public projects by municipality, in other word people typically tend to give or receive something in its return. In general for obtaining a proper understanding about ownership rights it is better to specify specifically the terms "right" and "property". The objective of this study is examining taking possession of lands by municipality from viewpoints of jurisprudence and law.

Key words: taking possession of lands, municipality, ownership rights

INTRODUCTION

In Iran due to prevalence of the true religion of Islam and its acknowledgement in the constitution, the legislator has used a lot of its rule as a legal article. Such as article 30 of civil law that states "Any owner has the right of any type of decision and benefit on its own property". And this convey the rule of dominance of owner to its own properties. The dominance in the lexical meaning equals to overcoming someone to someone else and this overcoming is by enforcement and in jurisprudential terminology it included jurisdiction of owner for any kind of decision within its own properties. Some termed is as the rule of dominance.

The rule of dominance is solidifying pillars of ownership. And with view to importance of the issue of properties and ownership, all new legal schools have accepted this rule. Article 30 and 31 of Iranian civil law has pointed out to it as well. One of the important basics of Islamic jurisprudence that is base of many other Islamic regulation is the rule of



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dominance that is associated with phrase of " the people are dominant to their properties " that demonstrates that anyone has the right to make any decision whether material or legal on its properties and no one can prevent it from these decision without legal permission. In enacting regulation about accomplishing public projects by municipality, attention of legislator to this rule is quite tangible. The supports that our legislator conducted in corresponding laws reveal the correctness of this claim. Some jurisprudents recognized fourfold reason (the book, tradition and wisdom and unanimity) as the evidence of this rule and among Quran verses they rely on verse 2 and 29 of surah An-Nisa and the verse 188 of surah Al-baqarah. Among narration the jurisprudence mostly rely on the aforementioned narration from the Prophet. This narration though is weak in term of documentary and does not stand among fourfold book. But instead the act of Shiite and Sunnite jurisprudents to its context compensate this weakness. Furthermore there are other valid narrations that convey the same concept.

Here we examine taking possession of lands by municipality from viewpoints of jurisprudence and law.

Applicability of rule of dominance in common laws

It is inserted in the article 23 of constitution that: "life, rights, residence and occupation of individuals is immunized from invasion, unless the cases in which the law prescribe". Also in the article 44 it is mentioned that" personal ownership that is earned from legitimate way is respected and its norms is identified by the law". These articles are based on the rule of dominance. Therefore in constitution of Islamic of republic of Iran regarding the rule of dominance, the ownership of individuals toward their properties is supported.

From other part in the article 31 of civil law in the same way as article 30 in support the ownership rights it is inserted that: no property cannot be removed out of its owner jurisdiction unless by law sentence . In enacting other articles this rule has been influential too. Even in commercial law this theory play pivotal role and legislator support ownership rights by such rule.

Applicability of the rule of dominance in special laws

In article 3 of legal bill of the manner of purchase and possession of lands and estates for accomplishing civil and military public project of government it is inserted: "fair price of lands, buildings, installations and other rights and sustained damages may be identified through agreement between executive institution and owner or owners and rightful persons". Also in single article of the law of the manner of appraisal of building, estates and land required for municipality mentioned that:" in all rules and regulations that municipalities are allowed to take possession of buildings, estates and lands from people in case of disagreement between municipality and the owner the price of buildings, estates and lands should be assessed and paid to current price.". Therefore it has been observed that in enacting regulation for accomplishing public projects by municipalities the legislator pay greatly attention to the rule of dominance and it is that making change in ownership rights of individuals by municipalities in many cases leads in paying indemnity. In this regard one can state that in enacting regulation about situation of ownership rights and at the time of implementing public projects by municipalities to which extent the legislator has paid attention to the rule of the dominance and power of ownership rights toward their properties. This means that one should pay attention to content of this rule as the primary rule and effective in enacting these laws and should maintain the value and respect of ownership rights in legal interpretations.

Situation of municipality agreement with the owner of estate**The theory of agreements as contract and its evidences**



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According to these viewpoints, municipality agreements with owners for implementing civil projects follow contract general rules and take place through one type of estate contracts. The theory of municipality's agreements with owners as contracts included in implementing civil projects is a dominant and putative theory among urban rights experts.

From the other side, the agreement between municipality and owners is that both parties, namely municipality and the rightful owner, should act by mutual consent toward taking possession. The first way for transferring ownership rights is using estate contracts that take place by compliance and agreement of both sides and regarding articles of law of purchase and possession of lands; this way is more preferable and appropriate than other methods. Therefore, if the ground is provided for the agreement, the municipality should use this way for meeting rights of owner.

In this regard, citizens can cede their ownership rights to municipality and government by use of sale, rent, reconciliation contract or other certain contract or the contract of matter of article 10 of civil law. This method contains complete respect to individuals' ownership right. In the law, the way of purchase and possession of lands as well as the law of appraisal of building and estates is addressed in an obvious manner.

From the other hand, some experts believe the term "agreement" mentioned in the law of the way for lands purchase and possession implies that two persons or more have consent and will-power in the contracts and obligations. Owner and municipality accomplish the contract in the manner that they have made consent about it. So that even without expert intervention, the agreements can be practical.

The expert who believes in municipality agreements with estates and lands owners as contract rely on some reasons or evidences as follows.

Inference from the law of lands purchase and possession

This law identifies the manner in which the private lands and estates purchase and possession takes place for accomplishing governmental civil or military public projects. According to this law, the legislator takes into account two methods for taking ownership of private estate by executive organ. Firstly, purchasing estates stands namely using agreement way, otherwise taking possession of required lands. Here it's worthy to mention that the second measure is a forceful state and regarding article 8 of mentioned law, it is dependent on existence of some obstacles for obtaining the agreement. Therefore, the primary principle in executing this law is the deal and purchase.

In this premise, the owner can avoid to accomplish the deal by rejecting municipality bidden price, though the bid is economically opportune and even be several times more than current price of the estate. This indicates the respect to freedom of will in contracts.

The term of price and damage

In article 3 of lands purchase and possession law, the terms "fair price" and "owners damage" is inserted, and its purpose is estate purchase and the civil responsibility. On this basis, the price is paid by the premise that there is an exchange contract and both parties have made consent to a certain price. The damage is posed when, without contract, some harms are sustained by owner by doing or failure to do certain acts.





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The term of making the deal and paying rights before performing the project

According to clause 2 of article 5 of lands purchase and possession law it is possible to pay exchanges or rights of estate owner before conducting the deal. In the law of determining state and situation of estates locating in governmental and municipality projects place approved in 1988 the municipalities are charged with that in case of official approval of the project utmost within eighteenth months they should engaged in fulfill the finalized deal or paying the price or the exchange of individuals estates. Using the term "deal" in this single article indicates that the situation of municipality possessory measures are as contract and implies its necessity of observing this contractual situation that is highly addressed by holy lawgiver.

It seems that the rules pertaining to possession by following this jurisprudential rule used in different cases the terms such as deal, agreement and purchase and so on. This suggests the dominance of the freedom of will principle and by consequence freedom of contracts principles.

The theory of agreement as taking possession of estate and its documents

Regarding aforementioned statements there are signs that municipal agreements with owners seems to be taking their possessions, and foster its forceful air. Some experts of urban rights consider municipality agreements with owners for performing civil projects as contract and dependent to regulations of contract. However in some cases some viewpoints by pointing to its forceful aspects considered it beyond the ordinary contract between owner and municipality.

It is premise of superiority of public right over private rights that lead these authors to pay more attention to forceful aspects of this type of agreements.

Endorsing public rights takes place by applying governments ruling right. The municipality benefits from this ruling power as a nongovernmental public institution and makes advantage from this power in its agreements with owners. The experts who considered these agreements as taking possession rely on some evidences as follows:

The regulations of article one of lands purchase and possession law

In article one of law of lands purchase and possession, the legislator considered the lands purchase and possession as allowable for the reason that it is required for executive organization such as municipality. Relied on this article, firstly the executive organizing when have the rights of people lands purchase and possession that have some programs for their on-time accomplishment that is necessary in terms of public and safety measures. Secondly this is approved by highest rank of executive organization. Thirdly its budget is assigned beforehand. And fourthly according to content of article one of mentioned law the purchase and possession takes place according to regulations inserted in this legal bill.

The municipality must trade according to content of this law. Therefore the municipality has not freedom of will so that in the same way as other purchaser could obtain agreement anyhow and purchase the estate. In this regard the legislator has determined the extent and the way of purchase and possession of people estates so that the municipality would not be able to act in the harm of the owner or the executive organization.

In the sale or other exchange contract the civil rights regulation is ruling, the purchaser at the purchase time can do the sale on credit. While based on the air of article one of this law the municipality should provide its funding before purchase (possession).





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In fact the purchase of the estate without providing the necessary funding is violation of law and its sanction is abolishing possessory measures.

From other side the municipality cannot conclude the contract, unless it had the approved project. The project should be approved by the highest executive degree of this institution.

Situation of make use of national and governmental lands

According to the clause one of article 2 of law of lands purchase and possession executive organizations and municipality are in charge with in order to accomplish their project use national and governmental as far as possible and if they intend to accomplish their project in private land, they should obtain confirmation for the lack of national and governmental lands in the place to from corresponding authorities. The legislator in the line with observing respect to others' properties make the executive organization in charge to use national and governmental lands for project accomplishment. The reason for using these lands is that these lands are handed to executive organization for free. And the purpose of legislator is observing economy in general assets of people.

Public resources of taking possession of lands by municipality

Regulations and directives approved in government board: the ministers can influence on the ruling order of ownership rights versus public projects in two ways. The first way includes providing and presenting a law to the Islamic consultative assembly and second way is approving executive regulation for laws.

Resources allocation of taking possession of land by municipality

In recent years in Iran urban planning and urbanity decision making are carried out within separate contracts by experts and consultants from other countries. But with time for this purpose a unit is constituted called the supreme council for planning and architecture. Therefore in 1972 the legislature has approved the law of establishing Iran's supreme council of planning and architecture and by this law attempted to bring about coordination among urban planning and better environment for people and to give rise to Iran architectural art and observing various traditional and national styles by considering new scientific and technical methods and construction regulations that was in accordance with regional and cultural conditions in Iran. Since 1990 the supreme council by keeping its position in approving projects, consigned approval of comprehensive project in war-stricken regions cities as well as the cities with the population of less than two hundreds thousands persons to a council with the directorship of governor-general that was called province council of planning and architecture [9]. The law has appointed some duty and jurisdictions as follows:

According to article 2 of law of establishing supreme council of planning and architecture the duties of Iran's supreme council of planning and architecture are as follows:

Examining necessary suggestion about planning general policies for presenting in ministers board.

Commenting about suggestion and bill of planning and regulations relation to urban comprehensive project including zoning, the way of using the land, determining industrial, commercial, administrative, residential, public installation and green religion and other public urban requirements.

Verifying and final approve of urban comprehensive projects and their changes out of detailed engineering.



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It is necessary to mention that as we know according to constitution the power of legislator is origination from Islamic consultative assembly. In this regard though the law appointed some jurisdiction for enacting and approving criteria and planning regulation for this council, but this council has not the right of legislation and in other word it has jurisdiction to create right or charge for persons. However it seems that this council can confine some ownership rights but it is not possible to negate the rights.

Relying of article 30 of civil law any owner has any right of any type of exploitation and utilization toward its property for example it can construct a building on it or divide it or aggregate the divided pieces. Therefore urban projects are confining somehow the ownership right. Also according article 38 of civil law the land ownership requires ownership of parallel spaces to any extent that it proceeds. The urban comprehensive project that is approved by this council specifies some regulations about utilization of occupation surface and space, the utility and density, dividing and aggregating, public spaces that confine the ownership rights of persons on their estates. Anyway these authentic resolutions are indispensable for persons and municipalities.

Though the supreme council of planning and architecture can enact some regulation regarding its authorities that confine the ownership rights to some extents, but this council cannot enact any resolution that negate ownership rights of people. In this regard the public board of administrative justice court announced this legal reality in various verdicts and explicitly states that this council cannot enact resolutions that bring about duties for persons or negate their ownership rights.

CONCLUSION

The issues about lands and estates have had special position from long time ago in Iran legal system, therefore it is indispensable to clarify regulations and criteria for estate and lands from different viewpoints. With progress of society and development of urbanization the city require public and civil projects more than ever and municipalities are in charge with extending the prosperity of cities. Municipalities in line with accomplishing their duties have to take possession of some estates and properties. Some of these properties are appropriate and the municipality can take possession or transfer them and the conditions of private contracts and civil laws are ruling their trade. From other hand the public properties belongs to the city and is for public use and its management is merely in charge of the municipality. Though people's ownership rights confirm their dominance over their properties, but it should be considered that sometimes due to some factors this ownership sustain some agitation. One of these cases is locating the estate within regions of future civil and public projects and by meeting all condition such as its approval by competent authorities, the owner have to transfer the estate or other ownership rights to the project executer and this legal duty is so decisive that in case of denial of owner the attorney general take the action immediately and in order to retain the public rights that the project requires it transfers the estate to executor of project as deputy of owner and in position of government. However the legislator does not neglect the owner rights and considered some conditions to respect the owner rights and to pay the fair exchange. In this case one attempt to neither neglect the ownership rights of persons nor neglect society public rights. in large cities and religious regions it is often happened that some bequeathed estates are located in future project region, and in this regard after victory of Islamic revolution in Iran some laws are approved in accordance to Sharia limitations that at the same time keep the position of bequests organization inspection and protects completely bequeathed estate, meanwhile one attempts to this would not be an obstacle in the way of accomplishing public project. In this regard contemporary high rank religious authorities (marja') have offered some fatwas due to understanding welfare of society so that neither impair in public project nor to persons rights. Therefore Iranian legislator in enacting regulation about implementing public projects has been rather in the side of observing public rights rather than ownership rights. There is no doubt that it is necessary to endeavor for achieving goals that encompass public benefit and provide social wellbeing. But the issue of how much



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persons and individual should pay the cost and to what extent they should neglect their freedoms and private ownership is important and noteworthy. In Islam religions one of principal source of right is to respect the private ownership. Thus it is opportune that the legislator while enacting such regulation pays more attention to private rights. The current situation of discussed laws is not such satisfactory and adequate and does not bring about necessary guaranty for respecting individuals owner rights. As a result by this current circumstance we can accuse the legislator to siding public rights and neglecting individuals' ownership rights.

With above descriptions it seems that the current laws require amendment. The amendment orientation should direct toward emerging judiciary supervision on the procedure of forceful possession of ownership rights, so that in the light of these supervisions one can prevent eventual autonomies and obstinacies. We should not neglect two points. Firstly this supervision though it is necessary but should not bring about prolonging and slowness on procedure of taking possession of ownership rights. Secondly it is better that this judiciary supervision takes place by certain judiciary authorities, this supervision is in the public interest as well as support the ownership rights

Suggestions

Reducing pessimism of people toward municipality can be emerged by effective advertisement such as exposing municipality balance sheet, specifying incomes, the way in which the obtained charges are spent, costs spent for the city and cost of future planning. Control and decrease of illegal constructions by municipality for increasing financial load for the municipality. Revising municipalities' law and necessary policies for receiving charges and tolls and indirect incomes of municipality directly by country department and paying it to municipality (by necessitating people in paying the tolls and charges on time). Reducing instability level in municipality income earning system structure through up-to-dating estate information bank for improving estate cover and identifying all payers of reconstructing charge. Collaboration and urban guidance toward investing in city real requirement and reducing municipality financial problems such as constructing educational centers and so on.

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RESEARCH ARTICLE

Review, Ratings, and Selection the Knowledge Management Strategies by Network Process Analysis (ANP) in the National Petrochemical Company

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Received: 22 Mar 2015

Revised: 21 Apr 2015

Accepted: 28 May 2015

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ABSTRACT

Knowledge management is a process that helps in selection, organization, production and distribution of knowledge and experience to gain competitive advantage. In fact, knowledge management is managing the flow of knowledge and delivers it to the users, who need it to act with greater speed and quality by that received knowledge. For this reason, it can be said that knowledge management is a tool to increase the "business intelligence" that is the most important profitable tool in today's business environment. In this study, using one of the best approaches to the selection and ranking of organizational strategies this issue was discussed, so that organizations choose the best strategy for knowledge management using this technique to make decisions with minimal risk in order to have the minimal additional costs or risks of failure. Therefore, this issue was investigated using network process analysis (ANP) and finally, this technique was used in the National Petrochemical Industries as a case study. There are problems, major obstacles and possible strategies for deployment and choosing the right strategy for knowledge management in Iran's petrochemical companies. Features such as extension, complexity, large number of employees and the importance of experience in this industry and particularly circumstances of the petrochemical industry in Iran including rapid progress, passing through the public system to the private system and entering the arena of global competition and need to use the new findings make the need of using knowledge management twice. Thus, in this study strategy review and ratings the Iran's National Petrochemical Company have been considered. The results of the eight main strategies ranking in the study indicate that knowledge management (which covers almost all aspects of knowledge management and is designed to be comprehensive) among the identified strategies with a coefficient of 0.322 has the

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first ranking in the National Petrochemical Company and from the perspective of employees and directors of the company. This suggests the importance of acquiring new knowledge regarding the rapid development of the petrochemical industry in the world. Thus, given the importance of this strategy, managers should make the fields and acquiring knowledge smoother in the company, so that technical and scientific knowledge and new staff be always up to date. Knowledge storage strategy with a weight of 0.205 is ranked second among the aforementioned strategy.

Key words: knowledge management, knowledge management strategies, ANP, Petrochemical

INTRODUCTION

In today's dynamic markets, companies do not require a high IQ for the success. The thing that can increase the intelligence in the organizations is the individual learning and collective learning of the encounter shadow and interaction of various ideas with each other. Having a clear and well-planned strategy is one of the ways to achieve success in knowledge management. This strategy is an important factor for an organization to organize its resources and capabilities to achieve goals in knowledge management. For greater attention to knowledge management strategy, it can be said that this strategy should be able to help the critical business issues in an organization. It is very important for organizations to know that which strategy of knowledge management they must focus on different conditions. Some studies suggest the complementary relationship between knowledge management strategies, while some other emphasize on pursuing strategies separately. Due to the above cases, ranking and selection of appropriate strategies is one of the challenges of leading organizations that is an important consideration in this study.

Multiple Attribute Decision making is used in a variety of practical problems that their aim is to prioritize and choose from several different options. Although, the information that is used by a decision maker is imprecise, uncertain and contingent due to the ambiguous nature of the problem, MADM appropriate method should be able to properly show interconnections between the index and also the option preferred by each indicator. In this study, ANP Multiple Attribute Decision making method was used. ANP is a mathematical theory that deals with systematically with various dependencies and has successfully been used in various fields. Analytic network process can be named as a complete multi-criteria decision-making method that has been proposed. Large set of experts and expertise is produced each day in our industry. Unfortunately, due to lack of knowledge management structures, outputs are short-lived and are lost quickly and without efficiency. There are problems, major obstacles and possible strategies for deployment and choosing the right strategy for knowledge management in Iran's petrochemical companies. Features such as extension, complexity, large number of employees and the importance of experience in this industry and particularly circumstances of the petrochemical industry in Iran including rapid progress, passing through the public system to the private system and entering the arena of global competition and need to use the new findings make the need of using knowledge management twice. Thus, in this study strategy review and ratings the Iran's National Petrochemical Company have been considered. In past, organizations sought to find and acquire data and information, but today they are faced with a massive amount of data and information. In many cases, management and proper utilization of them are other matters. Today, organizations are increasingly apart from themselves based on their knowledge and in fact, knowledge can be considered as the biggest competitive advantage in the global economy. Today, intellectual capital as a powerful force, being replaced rather than physical capital. In this study, using one of the best approaches for the selection and ranking of organizational strategies this issue was discussed, so that organizations choose the best strategy for knowledge management using this technique to make decisions with minimal risk in order to have the minimal additional costs or risks of failure. Therefore, this issue was investigated using network process analysis (ANP) and finally, this technique was used in the National Petrochemical Industries as a case study.





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Literature

About 5000 years ago in Mesopotamia (Iraq), people lost some of the registration certificate of legal contracts, KM book for estimation the sales tax and law. To solve this problem, the activity of the institution associated with the home began. Since then, experienced managers were attracted to collect all the plaques in the library. The first book about organizational learning and knowledge management was published in 1990. For example, Peter Senge's book called "five principles" or the book of Mr. Sakaya titled "knowledge value revolution" can be named. Over the years, a number of companies have instituted their knowledge management. There are many definitions of knowledge and knowledge management:

Knowledge is a combination of data and information that experiences, ideas, and skills of specialist were added to it and thus it is a valuable asset that is used in decision making (sarmiento, 2005). Knowledge management is a set of activities that helped the company to gain knowledge from inside and outside the organization. Knowledge management refers to the process of capturing certain professions and use of intelligence in organizations and using them to foster innovation through continuous organizational learning (Quinn, 1996). At a general level, knowledge management can be defined as a set of processes, which oversees the creation, dissemination and application of knowledge (Gupta, 2004). This definition involves creating a supportive organizational structure, facilitating relations, the use of IT tools in the network and the distribution of knowledge. Knowledge is the full utilization of information and data that are upheld with the experiences, skills, beliefs, vision, commitment and motivation of individuals.

In recent research in the field of knowledge management and knowledge management strategies, following cases can be mentioned. Persin Snelkoker 2010, in a study titled using the analytic network process for the selection strategy of knowledge management, used three strategies of human-centered, system-centered and a combination of network analysis techniques to prioritize knowledge management strategy in the production organizations of Turkey. Effective factors are cost, time, flexibility and quality that have been chosen with regard to technical, financial, cultural and strategic approaches. Zadehsarraf et al. 2013 have developed a TOPSIS method to normalize the data to choose the best strategy for the development of knowledge management in organizations. The computational results are indicative of the fact that since, personalization strategy can be involved in dependencies effects, knowledge management is the most appropriate strategy makes the assessment of the result more reasonable. Nekodari et al. (1390), identified and ranked the factors that facilitate factors of knowledge management in crisis management organizations. In their research, facilitators such as knowledge management in disaster management and administrative organizations and its subsidiaries, using variable data technology, strategy, structure and culture were identified and ranked. Friedman, T, factor analysis, and Pearson correlation test were used in this study to analyze the data. Based on the results from the perspective of the respondents, the factors of information technology and organizational culture to facilitate knowledge management was significant among the facilitating factors of knowledge management and in the strategy and there was not significance in structure factors as an effective factor to facilitate knowledge management. Among the four studied variables, organizational culture was the most important factor to facilitate knowledge management and strategy factor was the least important in facilitating knowledge management [2]. Network analysis method was proposed in 1986 by Saati and Takizava. ANP method is a generalization of the AHP method. In cases, where low levels effect on high levels and elements that are at one level is not independent, AHP method can no longer be used. ANP method is a more general form of AHP and consequently and shows more complex relationships between different levels networked and consider the interactions and feedbacks between the criteria and alternatives. ANP is a comprehensive and versatile method of decision-making, which is widely used in solving complex decision. In recent researches that have used ANP method for various issues, following cases can be mentioned.





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Analytical model of research

Research and analytical model is presented in the figure below based on the theoretical literature and theoretical models of customer satisfaction in the online environment, previous studies and related articles and interviews and inquiries from specialists and banking experts and academics. Conceptual framework based on research that analyzes the hierarchical model has been developed at three levels

First level :Which is related to the purpose of the model and research. It is the prioritization of knowledge management strategies and indicators associated with each strategy.

Second level: Related to the criteria or factors that strategies identified, weighted and ranked based on them. Ranking criteria for knowledge management strategies in this study are fully extracted and considered as follows:

Customer knowledge criteria :Identifying customers’ knowledge and awareness of their needs and expectations, customer satisfaction, customer retention, attract new customers, customer profitability, increasing the share

Stakeholder Relations: Improve the flow of knowledge between suppliers, employees, community stakeholders

Knowledge in processes :Application of the best knowledge during doing tasks (conducting knowledge to business and decision-making process)

Knowledge of individuals (intellectual capital) :Training and controlling mental power of employees that is the most valuable asset.

Third level: Which is related to the options that should be ranked. These options in the first stage are identified strategies of knowledge management and in the second stage are the indices related to each strategy in Sample Company. In the following, 8 species knowledge management strategies and factors and explain indicators are presented:

- Knowledge detection strategy
- Knowledge acquisition
- Expanding knowledge
- Transfer of knowledge
- Utilization of knowledge
- Maintain knowledge
- Storage of knowledge
- Assessment of knowledge

Conceptual framework of the research is depicted from graphical aspect since the ANP method exists between elements of the reciprocal relationship:

Indicators and explain factors of each knowledge management strategy

Indicators related to the knowledge detection strategy

Having a clear image of the organization's internal and external environment and their analysis led the identification knowledge. Transparency of internal and external knowledge is obtained illustrating the image of skills, information,





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resources, and risk factors associated with an organization's internal. Eight strategies and indicators, as indicators of the detection strategies have been identified, namely Clear image and staff analysis of the internal environment (strategy, objectives, strengths, and weaknesses, etc.) of the organization. Clear image and staff analysis of the external environment (opportunities and threats points, etc.) of the organization

- Awareness of staff from the type of knowledge that may be useful for the organization in order to gain it when facing
- Regular establishment of in-service training for staff
- The relationship between training topics with operational functions and organizational needs
- Being up to date, integration and automation of information systems and technology organization
- The level of expertise, education and attitudes of managers (the importance of organizational knowledge)
- Knowledge-based organizational culture

Indicators related to gain or establish knowledge strategy

Acquiring knowledge and skills that are not currently available and they are obtained through communication with customers and careerism. Nine strategies and indicators, as the indicators of the business strategy of the organization have been identified as follows:

- Encourage employees (financial and emotional) for collecting data
- Development of research activities among employees
- Gaining knowledge through normal channels such as conferences, internet, newspapers, magazines knowledge
- Gaining knowledge through informal channels such as customer, internal, informal meetings, social gatherings
- Leave and mission for employees to learn through, participate in seminars, training courses
- Quality of software and hardware infrastructure within the organization for the acquisition of knowledge
- Appropriate practical and service training
- The use of part-time educated consultants and outsourcing practical and research projects in the organizations
- Considering the personal knowledge in order to gain organizational knowledge when hiring staff

Indicators related to knowledge expansion strategy

- Creating expertise, skills, products, ideas, creativity and better, newer, more efficient processes are called the expansion of knowledge. Six strategies have been considered in order to extend knowledge:
- Establishment and strengthening the research and development section
- Regular operation and definition (annual) of research projects related to operational objectives
- Localization the achieved knowledge in the specialized manner in the form of organizational processes
- The positive interaction with other parts of the research unit in the organization
- The speed and amount of employees' access to newly gained knowledge
- The amount of company and management from entrepreneurial activities, creativity and new ideas of employees

Indicators related to the transfer or sharing of knowledge strategy

Knowledge transfer to appropriate locations and certain individuals are important. This work is done through the identification of specific expertise, which is related to responsibilities of the individuals. In this strategy, the knowledge between individuals (employees), internal structure and external structure of the organization are transferred. Nine strategies to improve knowledge transfer are identified as follows: Knowledge transfer from the individual capacities to the internal structure

- Knowledge transfer from the internal structure to the individual capacities
- Knowledge transfer from the internal structure to the external structure





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Knowledge transfer from the external structure to the internal structure
Knowledge transfer from the external structure to the individuals
Knowledge transfer from individuals to the external structure
Establishment of conferences or symposiums with customers
Establishment of conferences or symposiums with local groups (exchange of knowledge among internal structure and employees)
Job rotation technique and composition of the teams in order to transfer knowledge

Indicators related to the strategic use of knowledge

Application of knowledge in daily activities of the organization and efficient use of existing knowledge to solve problems of organization and utilization of knowledge. Five strategies for the proper utilization of knowledge that have been identified include:

Combination of production, operation, and services
Identifying the knowledge of customers
Change the School learning style to practical learning
Establishing a balance between the needs and desires of experts
Localization and specialized use of models and general software (management, accounting, etc.) in accordance with the needs of the organization

Indicators related to maintaining knowledge strategy

In line with the strategy of maintaining knowledge, all the information, knowledge, experience and expertise with the value of the organization's resources must be used. Thus, the selection process, storage and updating the knowledge of specific management and organization should be stored database and memory of the organization. In this context, five strategies are identified that include:

Fitness and update organizational infrastructure and software and hardware facilities
Selection of knowledge based on organizational needs and learning needs
Maintaining knowledge-based and competent human resources
Development of team learning
Conversion of employees' expertise and experience to systematic knowledge and designing a process for optimum use of it

Indicators related to knowledge storage strategy

Knowledge storage strategy is maintaining knowledge in the form of shapes, documents, data or software. In this regard and in order to optimize storage of knowledge, eight strategies for the study (NPC) are derived as follows:

Storage and retrieval training of knowledge (personal and organizational) to employees
Mechanization and the use of computers to encode and store knowledge
Identification and selection of useful information and knowledge by assessing their value
Encoding identified information based on the learning needs and organizational operations
Easy access to the stored knowledge across the duty boundaries of the organization
Storing knowledge based on topical classification
Storing knowledge based on the classification of learning needs of employees
Storing knowledge based on the classification of organizational goals for continuous improvement





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Indicators related to knowledge assessment strategy

Knowledge assessment strategy indicates that the prescriptive, strategic and operational knowledge should be assessed by appropriate methods and the success of the learning process from detection to maintain be measured. Seven strategies are identified and extracted in order to assess knowledge, which include:

Strategic review of the organization knowledge that assesses dynamic and competitive environment in terms of product, technology and market position of the company

- Review and revision of laws, procedures, and policies to the direction of the changing realities
- The attempt to establish performance evaluation systems such as EFQM and etc. to assess knowledge
- Using Bench Marking model (Benchmarking of the best) and similar companies to assess knowledge
- Assessment of managers' knowledge
- Assessment of internal processes and organizational culture
- Assessment of training and growing and learning processes

Descriptive statistics for the study

The following table presents descriptive statistics on the number (N), mean, Std. Deviation, Std. Error Mean, skewness and Kurtosis and minimum and maximum separately:

It should be noted that in this chapter, variables are presented briefly and the following symbols are used as variables in the software:

- A detection of equivalent knowledge
- B acquisition of equivalent knowledge
- C expansion of equivalent knowledge
- D transfer of equivalent knowledge
- E taking advantage of equivalent knowledge
- F maintaining the equivalent knowledge
- G storage of equivalent knowledge
- H assessment of equivalent knowledge

Skewness and Kurtosis coefficients were used to check whether the distribution is symmetric or not [6]:

If the coefficient of skewness is greater than 1.96, the distribution is asymmetric and if it is lower than 1.96, the distribution is symmetric and positive or negative coefficient indicates the left or right skewness.

If the coefficient of Kurtosis is greater than 1.96, the distribution is significantly skewed and if it is lower than 1.96, the distribution is approximately normal. If it is higher than pick, Kurtosis is positive and if it is lower than pick, Kurtosis is negative.

According to the obtained coefficients, if the skewness values for all variables be less than 1.96, the symmetric assumption of distribution can be accepted and the mean can be used as central tendency indicator and standard deviation can be used as distribution indicator. Also, it can be seen that Kurtosis coefficient of all variables is less than 1.96, so the distribution can be assumed normal.





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If the variables are quantitative and data distribution be symmetrical, parametric statistical models can be used. Otherwise, non-parametric statistical models must be used. Type of distribution (symmetry) is not important in non-parametric tests. Also, the sample is applicable, if they be less than thirty. Nonparametric tests are less accurate than the parametric tests.

Thus, it can be seen that reliable and accurate parametric models such as analytical hierarchy ANP can be used to analyze accurately.

Analysis of demographic information related to the questionnaire

As mentioned in the previous chapter, characteristics of age, gender (male or female), current posts in the company, the level of education of samples are given in the first part of the questionnaire that the following tables show the values of the characteristics of the sample:

Status of respondents by age

The number and percentage of respondent individuals by age are as follows

As is evident, the highest age group respectively is less than 30 years and 40 to 50 years that group of 40 to 50 years are the managers and individuals with experience and knowledge in the area with a very good level. The pie chart for age distribution of the sample will be explained below.

Status of respondents by gender

The number and percentage of respondent individuals by gender is as follows

Status of respondents by level of education

The number and percentage of respondent individuals by level of education is as follows

Validity and reliability of the research

As mentioned above, the purpose of validity is that scales and contents precisely measure the studied variables and subjects. This means that the collected data are not gathered through additional research tools and a part of the data is not removed in relation to variables and content. For example, in this study, if the tests could not show the effects of defined independent variables in terms of customer satisfaction, it will not have good validity. Inadequate measures can trump and discredit any scientific research. In the context of validity, nature of reality is questioned generally. Credit can be studied without focus on the scale variables. But, reliability assessment is not possible without examining the nature and meaning of the variables.

Validity of the questionnaire

In this study, most reliable method that is for interviews, comments and inquiries professors and experts and possible modifications is used for this work and assess the validity of the questionnaire. Using this method helped finding that how much methods and tools can assess the objectives of the research or whether the results can assess the hypotheses and research questions or not and finally, adopt this approach and rely on these tools to how much it measure the fact of problem, using the comments of experts and professors about questions and their ability. The



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validity of the questionnaire was provided, after obtaining the opinions of experts and academics and the amendment of the professors and advisors, modifications of some questions and conversion them to more understandable questions for the sample population and finally, remove some criteria or questions and adding other important questions.

Reliability of the questionnaire

In this study, Cronbach's alpha coefficient was used to identify the reliability (description and formulation of this method is given in Chapter 3 in the research). The Cronbach α values for each of the questions and variables was more than 0.85 and the average of this index was equal to 0.89 and thus, the reliability of the questionnaire was approved. Output tables of SPSS software are given below:

After calculating each of the four categories of knowledge management strategies based on individual criteria, the weight of the final table of the strategy are as follows:

Now, with combining and multiplication the above matrix in the ultimate matrix, prioritization of criteria or the final weight matrix based on the four criteria mentioned strategies can be achieved. Of course, super decision software performs this. Thus, the end points and the final weight of eight branches of knowledge management strategy is the following:

Thus, priorities and strategies of the eight factors of knowledge management with respect to the total sample and for all criteria are as follows:

- The first priority is storage of knowledge with coefficient of 0.163
- The second priority is maintaining knowledge with coefficient of 0.124
- The third priority is acquisition of knowledge with coefficient of 0.107
- The fourth priority is detection of knowledge with coefficient of 0.100
- The fifth priority is utilization of knowledge with coefficient of 0.065
- The sixth priority is expansion of knowledge with coefficient of 0.041
- The seventh priority is transfer of knowledge with coefficient of 0.026
- The eighth priority is assessment of knowledge with coefficient of 0.016

Incompatibility index rate (IR) was calculated, which is equivalent to 0.0452 that shows the significance of the model and verifying the calculations' process.

Prioritization results of the main strategy of knowledge management

The eight main strategies ranking results indicate that knowledge acquisition strategy has earned first place with a coefficient of 0.322 among the identified strategies of knowledge management (which covers almost all aspects of knowledge management and is designed to be comprehensive) in the National Petrochemical Company and from the perspective of employees and directors of the company. This suggests the importance of acquiring new knowledge regarding the rapid development of the petrochemical industry in the world. Considering the importance of this strategy, managers should smooth the fields and knowledge acquisition, so that the employees' technical and scientific knowledge be updated and new. Knowledge storage strategy with a weight of 0.205 is ranked second among the aforementioned strategy. So, one of the basic steps to optimize the implementation of knowledge management in any organization is detection and identification of useful knowledge for the organization. This subject has been diagnosed well by managers and staff of the National Petrochemical Company and they have ranked it in fourth place by giving high scores. Knowledge utilization strategy that shows the application of these



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selected strategies is assigned the fifth grade to itself. Knowledge expansion strategy with a coefficient of 0.055 has achieved the sixth place. This subject indicates the relative importance of the development and dissemination of knowledge of the internal structure of the organization. Therefore, given the importance of this strategy, managers must make the fields and channels of knowledge expansion smoother in the company in order to generalize the technical and scientific information and knowledge to each other and eventually the entire company. After this strategy, the strategy of transfer or sharing of knowledge allocated the seventh ranking with coefficient of 0.032 to itself. Transfer of knowledge causes the lack of rest between people and displacement of people, internal and external structures. In this study, this strategy has been detected among the 7 important strategies. Therefore, it is worthy that managers and practitioners participating in the study design and implement a mechanism to efficient and accurate and easy transfer of knowledge between participants, and the individual ability to the internal structure and the internal structure to individual capacities and the external structure to the internal structure. The use of job rotation technique and combining teams can also be helpful in this regard. Knowledge assessment strategy also ranked eighth with coefficient of 0.022.

The prioritization results of knowledge detection strategy

After prioritizing the strategies, the indicators related to each strategy were ranked. The results in the field of knowledge detection strategy show that from the perspective of experts and staff in the studied company: Two indicators of level of expertise, education and attitude of managers and the relevance of curricula with operational functions with the significant distance than other indicators are ranked first and second, respectively. Others were ranked as follows.

Prioritization results of expansion knowledge strategies

Prioritization results of expansion knowledge strategies show that two strategies of the company's support from entrepreneurship with a coefficient of 0.458858 and the rate and extent of employees' access to new knowledge with a coefficient of 0.2235 ranked first and second respectively. Others were ranked as follows.

Prioritization results of utilization knowledge strategies

Prioritization results of utilization knowledge strategies show that two strategies of identifying customers and awareness of their needs and expectations in national and international level with a coefficient of 0.45 and localization strategy with a coefficient of 0.235 ranked first and second respectively in order to benefit from the acquired knowledge. Knowledge localization issue is taken into consideration of researchers and analysts in various fields including management sciences in Iran in recent years that the second ranking refers to these important points. Knowledge needs to be localized first for a country and then be used to have a good performance. Others were ranked as follows:

Prioritization results of maintaining knowledge strategies

Prioritization results of maintaining knowledge strategies show that in order to preserve and maintain knowledge, knowledge selection strategy owned the first rank with an importance degree of 0.549 and a relatively large distance from the strategies to itself. Choosing this strategy as the first strategy seems quite reasonable from the perspective of population, because acquired knowledge that has much cost for the organization cannot be implemented in various processes and sections and be maintained for other uses in the future without the organizational infrastructure and appropriate hardware and software facilities and using traditional techniques and equipment. Others were ranked as follows.





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Prioritization results of knowledge storage strategies

Prioritization results of knowledge storage strategies show that in order to storing knowledge, coding strategy of identified information owned the first rank with coefficient of 0.283 and with a relatively large distance from the strategies to itself. This actually means the separation of applicable and usable information and knowledge is unnecessary. Others were ranked as follows.

Prioritization results of knowledge assessment strategies

Prioritization results of knowledge assessment strategies show that about the knowledge assessment strategy, review and revision of laws, procedures, and policies in order to being in the direction of changing realities owned the first rank with coefficient of 0.395 and with a relatively large distance from the strategies to itself. It is very important that in different strategies of knowledge management, the strategies that were relevant to the review and the re-engineering have obtained high ratings. Others were ranked as follows.

Prioritization results of knowledge acquisition or creation strategies

Prioritization results of knowledge acquisition or creation strategies show that development of research activities among employees depending on the type of ctivity in petrochemical companies is the most important and the most priority strategy in line with the strategy of knowledge acquisition and ranked first with coefficient of 0.338. Others were ranked as follows.

Prioritization results of knowledge transfer strategies

Prioritization results of knowledge transfer strategies show that in line with the strategy of knowledge transfer, two strategies: Establishment of conferences or symposiums with customers and establishment of conferences or symposiums with local groups have won the first and second preferences. Others were ranked as follows.

Conclusions and suggestions for future

In this paper, the strategies and measures and indicators of knowledge management in the petrochemical industry organization in Iran were ranked. The results show that the first priority of knowledge acquisition in the studied organization was the most important strategy of knowledge management in mentioned organizations.

Knowledge planning (defining the vision, goals, strategies, etc.): Knowledge planning is a tool for analyzing areas of knowledge and understanding of the characteristics and meanings, which in total makes up the transparency of organizational knowledge. It is recommended in the mentioned map, resource, flows, restrictions and end points in the organization be observed and understood.

Distance analysis: It is recommended to determine the true level of knowledge points in the organization using the experience and analysis and assessing gaps and existing lack of knowledge in the organization and compare it with the standards in this area. Knowledge management strategy formulation: There are different approaches to develop the knowledge management strategies. Each one is supported through a general model of knowledge management processes.

These cases can also be considered in future research

Identification and prioritization of knowledge management strategies using fuzzy analytic hierarchy FANP





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Integrating multi-criteria decision model (MADM) and multi-objective decision making (MODM) to design an optimal model of prioritizing knowledge management strategies

Design a model to select the optimal ERP system in an organization in order to implement knowledge management

Performance evaluation of knowledge management by balanced scorecard approach BSC

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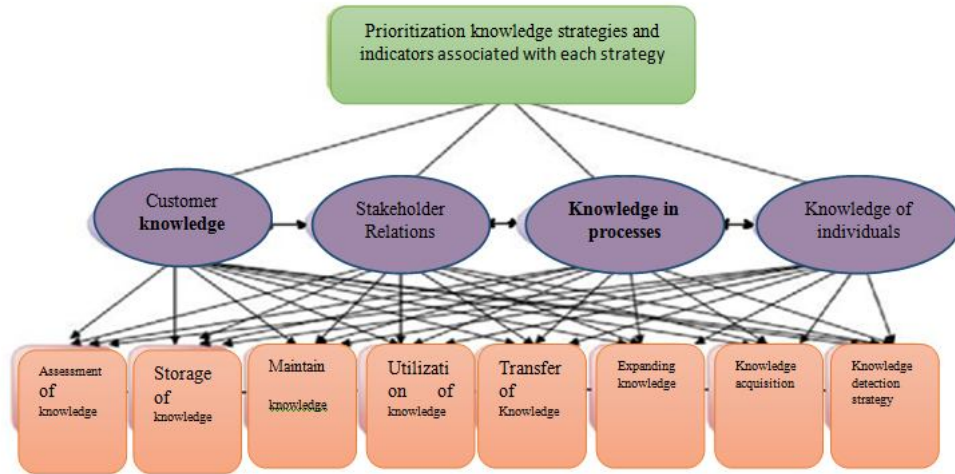


Fig 1- Conceptual framework of the study

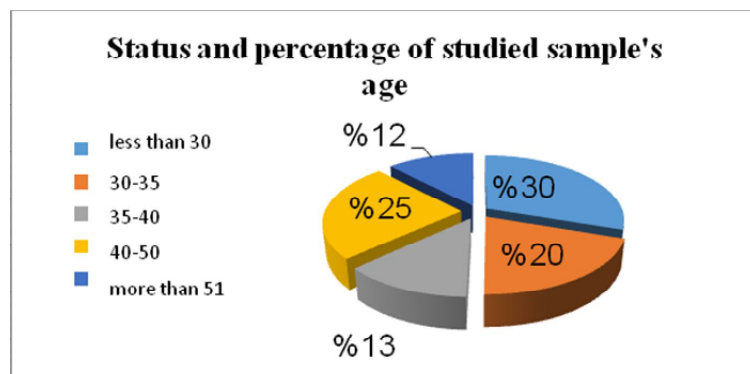


Fig 2- Percentage by age

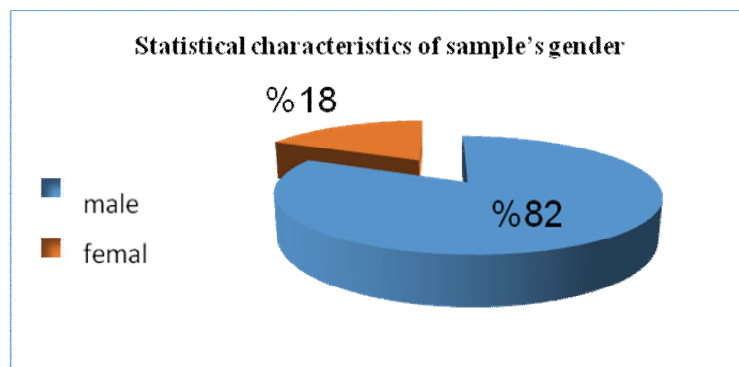


Fig 3 - Percentage by gender





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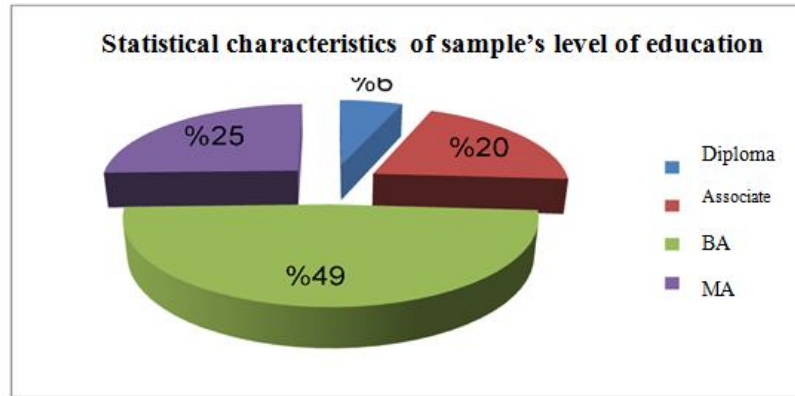


Fig 4- Percentage by level of education

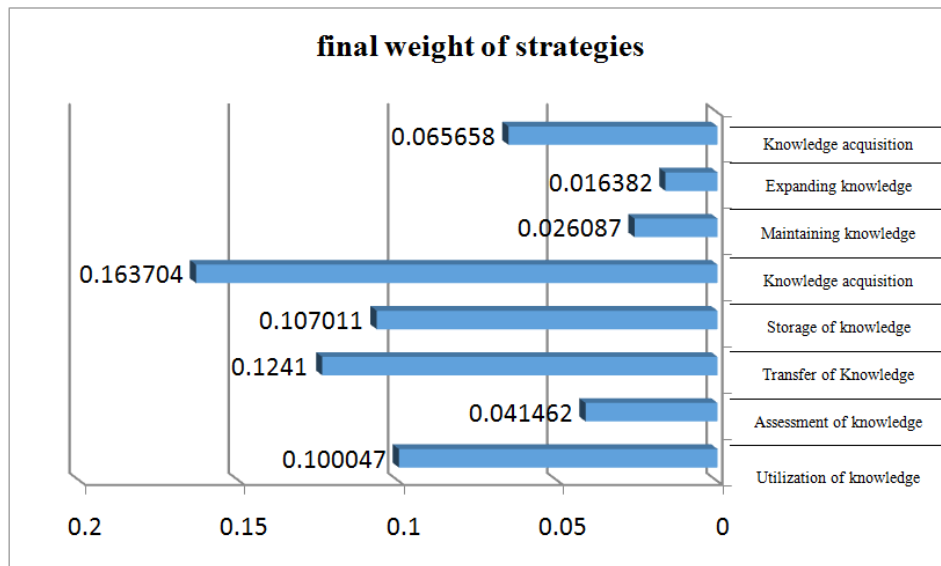


Fig 5. Final ranking of the knowledge management strategies





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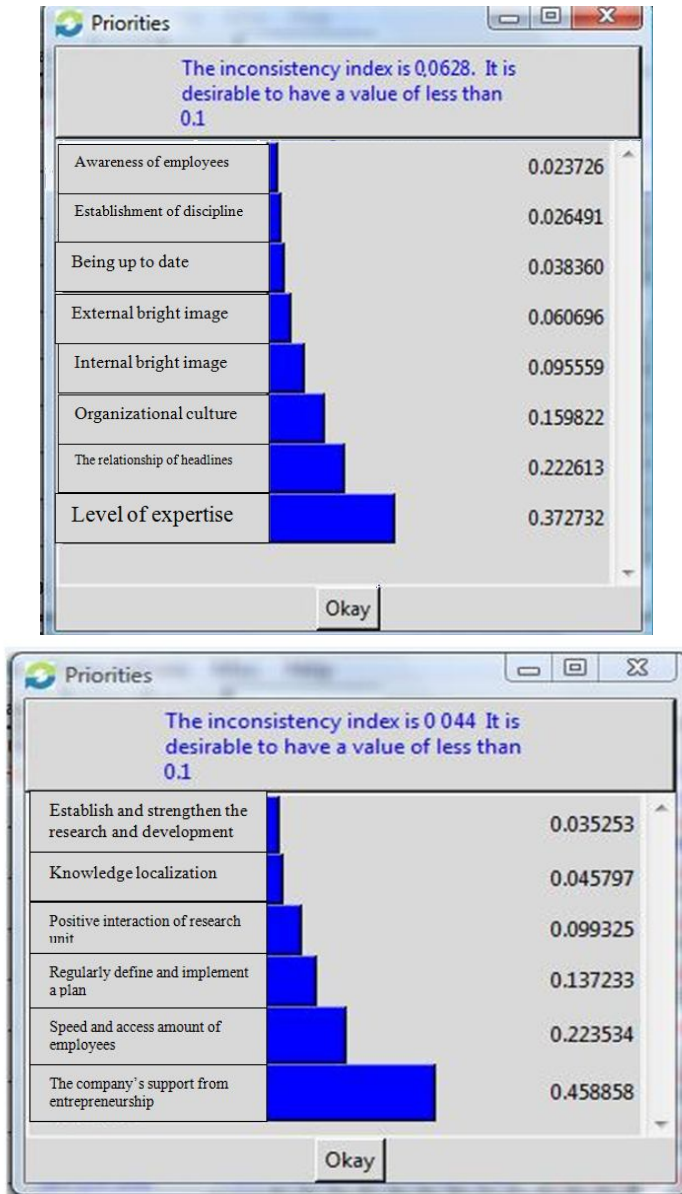


Fig 6- Prioritization results of expansion knowledge strategies





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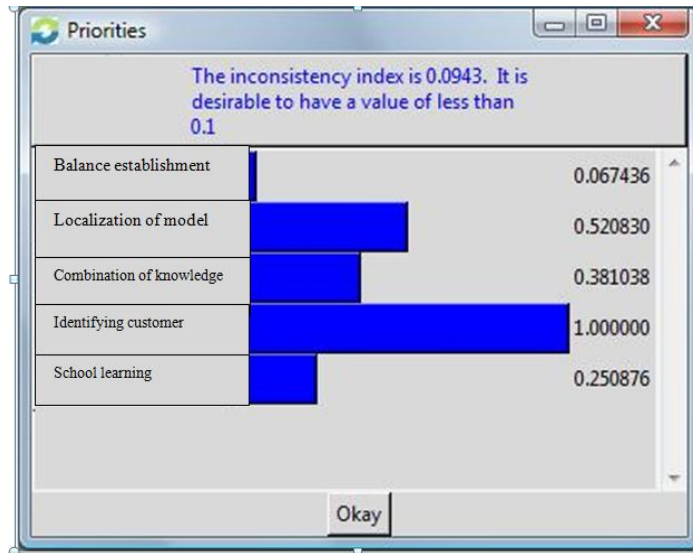


Fig 7- Prioritization results of utilization knowledge strategies

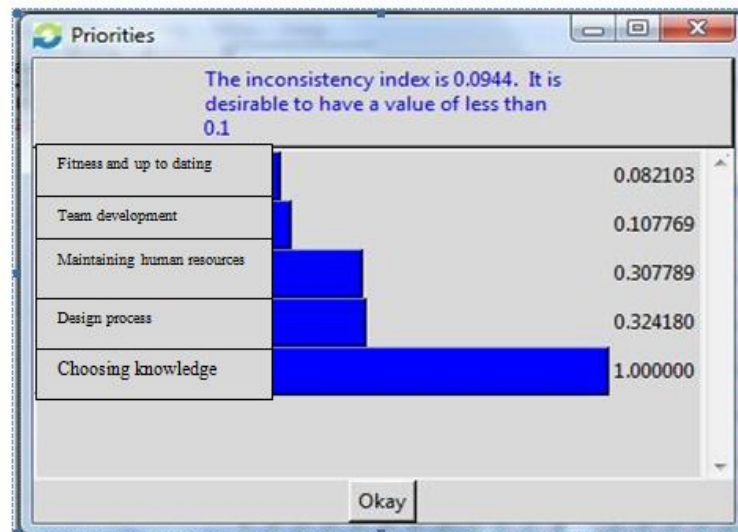


Fig 8- Prioritization results of maintaining knowledge strategies





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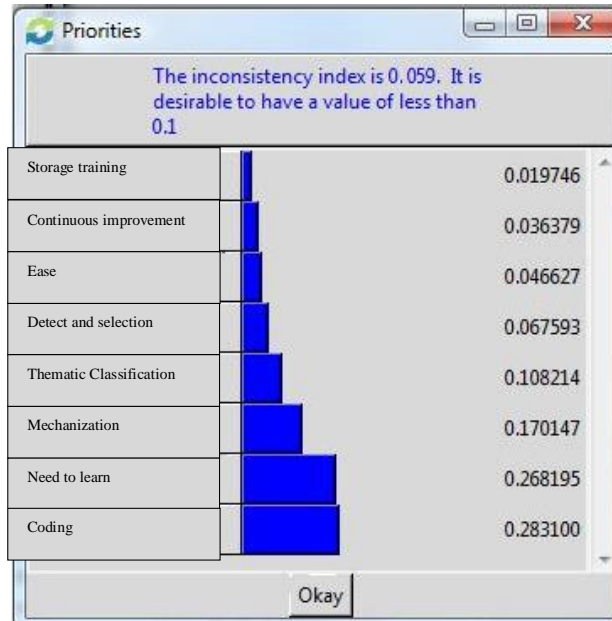


Fig 9- Prioritization results of knowledge storage strategies

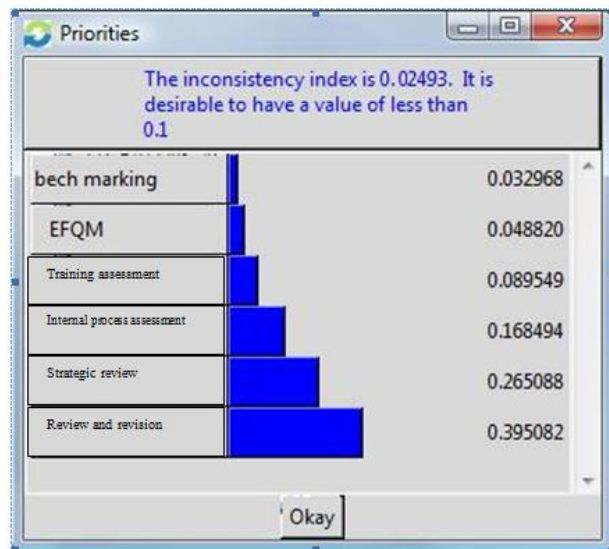


Fig 10- Prioritization results of knowledge assessment strategies





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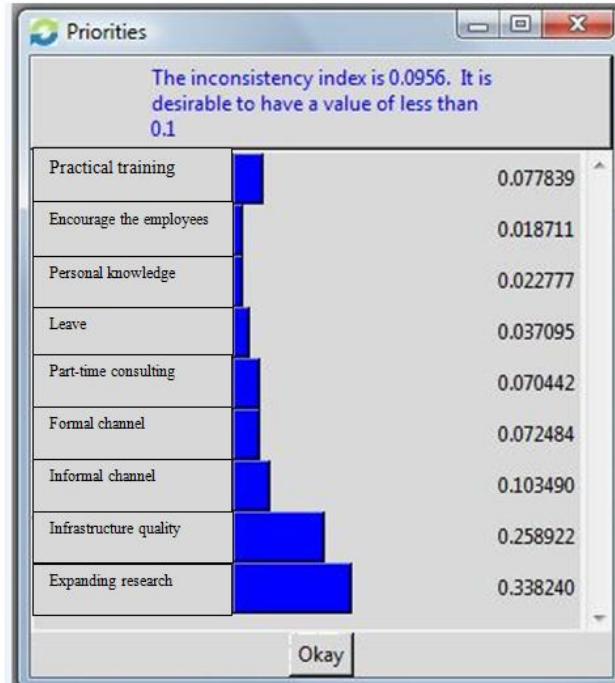


Fig 11-Prioritization results of knowledge acquisition or creation strategies

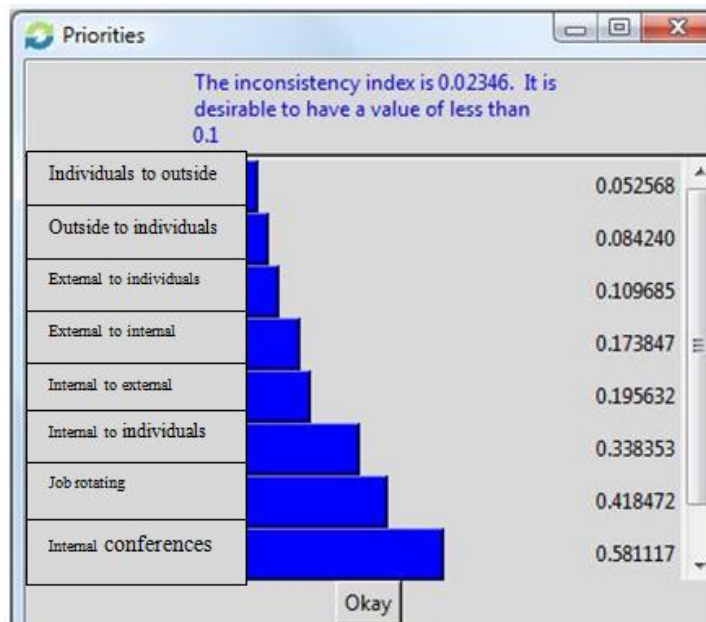


Fig 12- Prioritization results of knowledge transfer strategies





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Table 1-seven levels of knowledge in organizations

Key activities	Level	No.
Developing deep relationships based on knowledge sharing Understanding customer requirements Identify new opportunities	Customer knowledge	1
Improve the flow of knowledge between suppliers, employees, community stakeholders	Stakeholder Relations	2
Systematically environmental exploration, including the political, economic, technological, social and environmental trends Competitor Analysis Intelligent systems market	Perceptions of the business environment	3
Knowledge sharing Database of best practices Online Documents Areas of discussion, debate, and Internet	Institutional memory	4
Conduct of business and decision-making process	Knowledge in Processes	5
Knowledge-based services Surrounding production of knowledge	Knowledge in products and services	6
Knowledge sharing sessions Innovation Workshop Learning networks Knowledge and information technology society	Knowledge in people	7

Table 2- Recent Research for ANP

Year of publication	Authors	Reference	Name of article
July 2014	Selim Zaim et al	[2]	Using weighted ANP and fuzzy QFD for product development
July 2014	Snežana Tadić et al	[3]	Heuristic MCDM model based on fuzzy DEMATEL and ANP and Fuzzy VIKOR to choose a city for supplies and services
March 2014	Pablo Aragonés-,et al	[4]	ANP and AHP method based on multiple decision-making approach for selecting investment projects solar thermal power plants
January 2014	Adriaan Van Horenbeek, Liliane Pintelon	[5]	Developed a method for measuring the successful implementation of repairs using ANP method for selecting index maintenance performance





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January 2011	Ming-Lang Tseng	[1]	Using fuzzy MCDM model to evaluate the company's environmental knowledge management in uncertainty
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Table 3. Descriptive statistics of variables

	N	Mean	Std. Deviation	Std. Error Mean	MAX	MIN	Skewness	Kurtosis
A	165	6.0085	.74962	.11852	9	3.67	-0.19	-1.24721
B	165	5.9390	.65800	.10404	9	3.56	-0.45	-0.63151
C	165	6.3005	.83988	.13280	9	3.33	-1.01	0.37307
D	165	6.3438	.69956	.11061	9	3.75	-1.16	0.279843
E	165	7.1837	.63770	.10083	9	4.63	-0.81	0.16565
F	165	5.9843	.81748	.12925	9	4.17	-0.64	0.52196
G	165	6.1918	.76690	.12126	9	3.50	0.29	0.334403
H	165	5.8293	.68832	.12933	9	4.23	0.34	0.4091

Table 4. Statistical characteristics sample's age

percentage	Number	Age	No.
0.30	50	Up to 30	1
0.20	33	30-35 years old	2
0.13	21	35-40 years old	3
0.25	41	40-50 years old	4
0.12	20	More than 51 years old	5

Table 5. Statistical characteristics of sample's gender

percentage	Number	Gender	No.
%82	135	male	1
%18	30	female	2

Table 6. Statistical characteristics of sample's level of education

percentage	Number	Level of education	No.
%4	4	Diploma	1
%35	37	Associate Degree	2
%58	61	Bachelor	3
%3	3	Master of Science	4





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Table 7. Cronbach's alpha coefficient

		N	%
Cases	Valid	165	100.0
	Excluded a	0	.0
	Total	165	100.0
Reliability Statistics			
Cronbach's Alpha		N of Items	
.896		8	

Table 8- prioritization of knowledge management strategy based on the each Quad criterion

Cluster Node Labels		Options							
		Assessment of knowledge	Transfer	Expanding	Utilization	Knowledge detection	Maintain knowledge	Storage of knowledge	Knowledge acquisition
Option	Assessment	0.019804	0.024551	0.024931	0.018329	0.015488	0.027189	0.015910	0.026246
	Transfer	0.028443	0.043306	0.038963	0.042107	0.036514	0.029497	0.030724	0.030270
	Expanding	0.041306	0.054300	0.073352	0.041296	0.048764	0.052925	0.049441	0.064278
	Utilization	0.082068	0.121234	0.043898	0.074002	0.061008	0.098536	0.089989	0.093560
	Knowledge detection	0.103745	0.072092	0.125216	0.163365	0.153716	0.132673	0.124719	0.102065
	Maintain knowledge	0.204465	0.180546	0.000000	0.175158	0.125616	0.204538	0.177300	0.134952
	Storage of knowledge	0.204917	0.191678	0.287540	0.099265	0.258130	0.193976	0.234313	0.189103
	Knowledge acquisition	0.315252	0.312292	0.406100	0.386478	0.300764	0.260664	0.277605	0.359524

Table 9. Prioritization of and final weight of knowledge management strategies

The final weight of strategies	Knowledge management strategies
0.100047	Knowledge acquisition
0.041462	Expanding knowledge
0.124100	Maintaining knowledge
0.107011	Knowledge acquisition





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0.163704	Storage of knowledge
0.026087	Transfer of Knowledge
0.016382	Assessment of knowledge
0.065658	Utilization of knowledge





RESEARCH ARTICLE

Investigation of the Effect of the Degree of Openness of the Economy on Real Effective Exchange Rate Fluctuations: Case Study

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Received: 13 Nov 2015

Revised: 21 Dec 2015

Accepted: 4 Jan 2015

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ABSTRACT

This paper reviews and detects the important factors affecting the real effective exchange rate fluctuations in the economies of the countries known as BRICS during the period 1995-2012. The results of estimating the model by the method of dynamic panel suggests that the variables including liquidity growth and net capital flows have a significant and positive impact on the real exchange rate fluctuations in the mentioned economies, and the variables including degree of openness, government expenditure and foreign exchange reserves have a significant and negative impact on it. While the impact of the variables, the growth of labor productivity and financial development index on the real exchange rate fluctuations is insignificant. Also in this article with emphasis on Obstfeld - Rogoff model, the effects of the interactions between the degree of openness of the economy and the variables including growth of labor productivity, liquidity growth and government expenditure has been tested on real exchange rate fluctuations, and increasing the degree of openness in the economy of BRICS countries leads to reducing the influence of nominal money supply shocks on real exchange rate fluctuations but its interaction with government expenditure shocks has a positive and significant effect on real exchange rate fluctuations.

Keywords: real exchange rate fluctuations, degree of openness, dynamic panels, emerging economies

INTRODUCTION

The real exchange rate is one of the main indexes in determination of the degree of competitiveness of economies and explanation of domestic and foreign situation of the economy. The constant fluctuations in the real exchange rate and



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its impact on domestic and foreign prices leads to increasing uncertainty and instability of macroeconomic and reducing the investments in the real economy and increasing tendency to speculative and brokerage activities. Research results show that the value added of the economy has a negative relationship with exchange rate fluctuations and its deviation from the equilibrium path. In the other words, deviation of the real exchange rate from its equilibrium path and overvaluation of the domestic currency reduce the competitiveness power of domestically manufactured goods in international markets and, therefore, reduce the profitability of production. Also deviation of the real exchange rate as a disturbance in the relative prices of society leads to capital flight from the country as well as diverting the resources and capital from their optimal allocation. In fact, real exchange rate fluctuations reflect the instability and uncertainty in the trend of relative prices that increases the risk and uncertainty in investment returns and thus, the economic agents are not able to predict economic policies and their incomes, so increasing real exchange rate fluctuations will reduce the production in the economy.

With the collapse of the Bretton Woods system in 1971 and the advent of floating exchange rate regime in the most economies in the world, the nominal and real exchange rate faced severe fluctuations (Stockman, 1983; Mussa, 1986). Many economists condemned and blamed monetary authorities for the formation of such fluctuations, according to Flemeing - Mundell (1962) and Dornbusch (1976), implementation of unpredictable monetary policy shocks by the central bank leads to the formation of the nominal exchange rate fluctuations and ultimately fluctuation in the real exchange rate. In fact, in their opinion, the nominal exchange rate fluctuations, as a nominal price was the main reason of real exchange rate fluctuations, which is mainly due to arisen disruptions in financial and monetary markets (nominal shocks), and it's because of the slow adjustment of goods and services market against financial markets in case of such shocks in the economy. However and despite the efforts of many economies to stabilize the monetary policy, and reduce monetary and fiscal disturbances, the amount of fluctuations in the real exchange rate has not been reduced (Rogoff, 1999), which is why many economists questioned the theory of Dornbusch (1976), rejected the hypothesis of instability in monetary policy, as the only factor of real exchange rate fluctuations, and considered the monetary models incapable to predict the real exchange rate fluctuations (Meese & Rogoff, 1983).

Calderon (2004) has examined real exchange rate fluctuations in the framework of the "New Open Economy Macroeconomics" and considered non-monetary factors such as productivity shocks, government expenditure, terms of trade, the degree of openness of the economy and the kind of the system of exchange rate as effective factors separated from monetary factors in the creation of the real exchange rate fluctuations, and in the meantime, Stancik (2006) considered the degree of openness of the economy more effective compared to other factors, especially in emerging economies.

Some studies by the other economists suggests that under a floating exchange rate system in many developed countries, real exchange rate movements have random walk, largely due to the stickiness of prices in the short term¹. Therefore real exchange rate convergence towards purchasing power parity is very difficult. Most economists failed in rejecting the hypothesis of random walk behavior of real exchange rate even in the long term (Rogoff, 1996) and the reason of real exchange rate random walk motion was of special interest of economists, as the study of Bleaney (2006) suggests the openness of economies reduces the real exchange rate fluctuations and the loss of its random walk motion, and economies with similar fluctuations in the nominal exchange rate, in case of further interaction with the foreign economies, have less fluctuations in real exchange rate, and it's also because of the adjustment of price level associated with the nominal exchange rate fluctuations. In this paper, by using dynamic panel econometric techniques and based on the model of Obstfeld - Rogoff (1995 and 1996), we investigate the effect of the degree of openness of the economy on the real exchange rate fluctuation in the economy of BRICS² countries by considering the other

1. In fact, monetary and financial shocks influence the nominal exchange rate in the short-term and lead to real exchange rate fluctuations.

2. Brazil, Russia, India, China and South Africa





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independent variables such as government expenditure, the growth of labor productivity, liquidity growth, net capital flows and financial development. The interaction effects of productivity and monetary shocks and government expenditure with the degree of openness of the economy on the real exchange rate fluctuations have also been examined. The second and the third part of the paper are devoted to the literature and the conducted studies in this field. In the fourth part, the model, test methods and interpretation of the results will be presented. The final part of the paper is devoted to the conclusions of the discussions and the final considerations.

Theoretical and empirical foundations

The different definitions of the real exchange rate will be presented. Real exchange rate is generally the ratio of the index of commodity prices in the commercial side country to the index of commodity prices inside the country, which can be expressed on the basis of a common currency, and changes in this index represents changes in the competitiveness power of domestic goods.

$$REER = NER \frac{P^*}{P}$$

In above equation, REER is real exchange rate, NER is nominal exchange rate, and P and P * are domestic and foreign consumer price index respectively.

In another definition, the real exchange rate is called to the ratio of the price of tradable to nontradable goods prices.

$$RFFR = \frac{P_T}{P_{NT}}$$

P_T is tradable goods prices and P_{NT} is non-tradable goods prices in the domestic economy. The main disadvantage of this method is that in practice there is no fixed border for tradable and nontradable goods to be able to calculate the price index.

Given that the real effective exchange rate has been used in this article, the real effective exchange rate refers to the weighted average of the value of the national currency of a country related to the value of the national currency of other countries and in fact it is the weighted average of the real exchange rate and the weights are determined based on the relative importance of the trade of the country with each of the trading partners.

$$REER = \left[\prod_{i=1}^m [E_{di} \cdot PC_i]^{w_i} \right]^{\frac{1}{\sum w_i}} = \left[\prod_{i=1}^m BRER_d^{w_i} \right]^{\frac{1}{\sum w_i}}$$

In the above equation, PC_d is the goods price index of the country, PC_f is the goods price index of the foreign country, E_{di} is nominal exchange rate, BRER is real exchange rate and m is the number of trading partners. In the above equation, the geometric mean has been used and w_i is the proper weight for the country i (Hinkle & sangiyumva; 1999).

According to "New Open Economy Macroeconomics" factors affecting the real exchange rate fluctuations divides into two categories of monetary and non-monetary factors. The first viewpoint which has been introduced by Dornbusch (1976) indicates that unpredicted monetary shocks through the exchange rate overshooting can lead to the creation of fluctuations in the exchange rate. In the other words, low speed of adjustment of goods and services market compared to the financial markets will cause a very severe effects of monetary shocks on the exchange rate in short term. According to the second viewpoint, which have been proposed by economists such as Stockman (1988), Macdonald (1998) and Obstfeld - Rogoff (1995 and 1996), in addition to the influence of monetary shocks on exchange rate fluctuations, non-monetary factors such as productivity shocks, the degree of openness of the economy and government expenditure shocks can be effective on real exchange rate fluctuations. Each of these viewpoints will be discussed in the following.





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Dornbusch theory (monetary theory of exchange rate fluctuations)

This model suggests that the exchange rate fluctuations have a monetary root. The model has been proposed by Dornbusch in 1976 in a monetary model for the first time. He has presented his discussion in the form of a standard Flemeing - Mundellmodel in a small country, with the assumption of floating exchange rate and full capital mobility, and by assuming the establishment of purchasing power parity (at least in long term), based on three commodity market, money and financial assets. In the sense that if the economy is exposed to permanent unexpected monetary expansion policies, exchange rate in the short term exceeds its equilibrium value in the long term and again, the new equilibrium level will be obtained in the long term, in which the condition of purchasing power parity will be established again.

In this view, the exchange rate overshooting is basically a short-term phenomenon which comes from the non-uniform speed of adjustment in commodity markets and financial markets. In other words, since prices are not adjusted immediately due to the existence of stickiness in the commodities market, shock from increased nominal volume of money appears in the form of the exchange rate overshooting due to flexible financial assets market, and over time, the immediate effects of the shock are resolved gradually, and goods markets and money and asset markets are reached to an equilibrium. Overshooting of the exchange rate is cleared through money demand relationship.

$$M = P \cdot L(r + \Pi^*, Y) \quad (1)$$

In which, r is the real interest rate, L is money demand function, P is the general price level, M is nominal volume of money, Y is national income and Π^* is the expected inflation. General Price level is a balanced combination of tradable (p) and non-tradable ($E p^*$) goods prices. General Price level will be as follows if we show the contribution of these two by the value of α and $\alpha-1$ ($1 > \alpha > 0$) in general price index:

$$P = p^\alpha (E p^*)^{1-\alpha} \quad (2)$$

In which, E is nominal exchange rate, p^* is foreign price level. With replacement of equation (2) in equation (1), we'll have:

$$M = p^\alpha (E p^*)^{1-\alpha} \cdot L(r + \Pi^*, Y) \quad (3)$$

According to the above equation and assuming a constant demand for money and the constant general price level in two countries in the short term, it can be seen that any increasing in the volume of money affect the exchange rates directly, as the most sensitive variable. Due to the contribution of tradable goods prices (which is smaller than one) in

the general price level, the exchange rate increasing will be much higher than increasing in the volume of money. By differentiating of equations (1) and (2) and their replacement in each other, we'll have:

$$\frac{\partial E}{E} = \frac{1}{1-\alpha} \cdot \frac{\partial P}{P} = \frac{1}{1-\alpha} \cdot \frac{\partial M}{M} \quad (4)$$

Since $1 / (1-\alpha)$ is larger than one, so $\partial E / E$ will be larger than $\partial M / M$. Since there is a greater change in the exchange rate compared to the volume of money, equation (4) refers to the exchange rate overshooting.

The adjustment process of the exchange rate overshooting is that after the unexpected increase in the volume of money, the exchange rate will be increased immediately. This means that increasing in the volume of money will be followed immediately by reducing the interest rate, which is a contradiction regarding the interest rate parity





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relationship. Therefore, in order to neutralize the effect of interest rate cuts, the exchange rate should be overshooting sufficiently in order to devaluation of the national currency, so its return to long-term equilibrium rate in line with increasing the value of the national currency, compensate the interest rate cuts. In the process of adjustment, it is necessary that price level, interest rate and exchange rate tend to their long term equilibrium value. So that the changes in the general price level, the volume of money and exchange rate would be identical. In Dornbusch theory, it is assumed that foreign and domestic financial assets are perfect substitutes for each other, and also adjustment in the general price level is done slowly.

The source of non-monetary exchange rate fluctuations

Productivity shocks

According to Balassa-Samuelson effect, if the productivity of tradable sector is higher than the non-tradable sector, in this case, wage increase in tradable sector lead to pressure for wage increase in non-tradable sector, without changing the productivity. Therefore, this leads to an increase in prices of non-tradable goods and by assuming a constant price for tradable goods in two countries, consequently, in a country with high productivity of tradable sector, general price level and real exchange rate will decrease. Based on the mentioned theory, the economy are divided into tradable and non-tradable sectors and the price of non-tradable sector is a function of the productivity difference between tradable and non-tradable sectors of the economy. In other words, productivity growth in the tradable sector will lead to the price growth of non-tradable sector. In fact, the internal transmission mechanism of Balassa-Samuelsson effect is as follows:

$$P_{NT} = \frac{\delta}{\gamma} \Delta_T - \Delta_{NT}$$

P_{NT} is the price growth of non-tradable sector, Δ_T is the productivity growth of tradable sector, Δ_{NT} is the productivity growth of non-tradable sector, δ and γ are production elasticity in non-tradable and tradable sectors respectively

relative to the labor force. Therefore any increase in productivity of tradable sector leads to an increase in prices of non-tradable goods, and according to equation $REER = \frac{P_T}{P_{NT}}$ the real exchange rate decreases.

Government expenditure shock

Government consumption expenditure also influence the real exchange rate. This effect depends on whether the mentioned expenditure, affects consumption of tradable goods or non-tradable goods.

Edwardes (1989) suggests that an increase in government expenditure will increase the demand for non-tradable goods and services at first, which leads to increase in the prices of non-tradable goods. As a result, the real exchange rate will decrease and gets away from its long-term and the domestic currency will be strengthened. In the next step if the increase in government expenditure comes from tax increases, this reduces the disposable income of households and leads to decrease in consumption and prices of non-tradable goods. Thus, the impact of increased government expenditure on the real exchange rate is ambiguous. On the other hand, if the increase in government expenditure is towards production and leads to increased investment and production of goods and services within the country, in this case, non-tradable goods price will decline and real exchange rate will increase.

Net capital flows

Capital flows to the inside affect the relative price of non-tradable to tradable goods and consequently it will affect the real exchange rate. Any increase in capital flows to the inside can increase demand for non-tradable goods and consequently their prices. This leads to a decrease in the real exchange rate and the strengthening of the domestic currency.





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Foreign exchange reserves of the Central Bank

Reserves of the Central Bank indicates the ability of this bank to defend the value of the national currency of the country. Accordingly, an increase in the reserves, leads to strengthening of the domestic currency or decreasing in the real exchange rate. While the reduction in this reserves, will weaken the domestic currency and the increase real exchange rate.

Financial Development

Financial development can reduce the exchange rate fluctuations, in the other words, financial development can facilitate agencies' accessibility to finance especial resources of needed exchange and make them protected against the effects of exchange rate fluctuations. The role of developed financial markets, as a currency broker in exchange transfer from the sectors with excess exchange to the sectors with deficient, is important and financial development can increase the productivity growth of firms by reducing the exchange rate fluctuations. In fact, the firms that are exposed to liquidity shocks and forced to borrow in the market. For these firms, their borrowing capacity is a coefficient of their current income and this coefficient is determined by financial development. The more the financial development, the higher the mentioned coefficient. Given that the firms engaged at the international level and domestic prices, and consequently the firms' income would be affected by the exchange rate, so the current income of firms will be decreased by the exchange rate appreciation and their ability to borrow will be reduced against liquidity shocks. As a result, existence of the financial difficulties will reduce the innovation in the firms, in which their innovation and liquidity is a function of liquidity flow. Therefore, the lower the financial development index (the ratio of debt capacity to earnings), the more being susceptible to fluctuations in innovation and consequently the productivity growth for the firms. But financial development, by providing the necessary foreign exchange firms, reduce exchange rate fluctuations and liquidity shocks on firms and leads to a positive effect on the economic efficiency of firms.

The degree of openness of the economy

Jorge and Romain (2008) have investigated the effect of degree of openness of the economy on the real exchange rate through the two channels. First through the liberalization and reforming the trade policies, for example, decreasing import tariffs may increase the demand for the import, which is part of tradable goods, and leads to a decrease in demand and prices of non-tradable goods and consequently increase in real exchange rate. Also, an increase in import

tariffs can have an opposite effect. The degree of openness of the economy, in its direct impact on real exchange rate, can cause deviation and fluctuation from its equilibrium value in the long term.

Second, the degree of openness of the economy can reduce fluctuation of real exchange rate indirectly, this means that the greater the degree of openness of the economy, the impact of monetary and non-monetary shocks on the real exchange rate fluctuation is reduced and the relationship between these two has been proved by Obstfeld - Rogoff (1995 and 1996). In their model, any real shocks inflicted on the economy through creating shock in tradable goods price (\tilde{P}_T) can affect the real exchange rate fluctuations, but with the increasing degree of openness of the economy, the effectiveness of the shocks on the real exchange rate fluctuations are reduced. This means that, we have:

$$\tilde{q} = \tilde{E} - \tilde{F} = \tilde{E} - \gamma \tilde{P}_T = (1 - \gamma) \tilde{P}_T$$

$$\text{Var}(\tilde{q}) = (1 - \gamma)^2 \text{Var}(\tilde{P}_T)$$





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In above equation, $\text{Var}(\tilde{P}_t)$ is the variance of tradable goods price, which is affected by nominal money supply shocks and real shocks of the economy such as the productivity changes of labor, government expenditures and other variables. Also $\text{Var}(\tilde{Q}_t)$ is the variance of the real exchange rate and γ indicates the degree of openness of the economy.

Empirical studies

- Hau (2000) has investigated the relationship between the real exchange rate fluctuations and the degree of openness of the economy for 54 industrialized countries by using cross-sectional data from the year 1980 and the results has indicated that there is a negative relationship between the real exchange rate fluctuations and the degree of openness of the economy and in his study, one percent change in the degree of openness of the economy led to 52 percent decreasing in the real exchange rate fluctuation.
- Caporale et al (2009) have investigated the factors affecting the real exchange rate fluctuations in 39 developing countries, by using dynamic panel data approach, with emphasis on monetary factors, external factors and real shocks, and their findings indicate that among the variables affecting the real exchange rate fluctuations, the degree of openness and fluctuations the volume of liquidity are considered as the important effective variables, and the real exchange rate fluctuations are reduced by increasing degree of openness.
- Hausman et al (2006) have studied the difference between real exchange rate fluctuations among the countries, by using data from 74 industrial and developing countries over the period 1980-2009. They've suggested that the exchange rate fluctuations in developing countries is almost 3 times higher than in industrialized countries. Their results indicate that the difference in exchange rate fluctuations between these two groups highly depends on the levels of financial development and the degree of openness of their economies.
- Agarwal (1998) has studied the effect of the liquidity volume variable, interest rate and foreign and domestic price index on the behavior of the real exchange rate and his results suggest a positive effect of domestic price index and money demand on exchange rate and a negative relationship between foreign price index and interest rate with the exchange rate.
- Cerda (2002) has studied the impact the degree of openness of the economy on the real exchange rate fluctuations in America and his results suggest a lower real exchange rate fluctuation in this country due to the high volume of trade with other countries.
- Magoy and Agarwal (2011) have studied the relationship between the trade volume and exchange rate fluctuations by using the data of the important exchanges such as US dollar, British pound, Canadian dollar and Japanese yen and their findings show that there is a negative relationship between the trade volume and the exchange rate fluctuations.
- Calderon & Kubota (2009) have investigated the impact of the degree of trade openness on the real effective exchange rate fluctuations in 82 developed and developing countries over the years between 1975-2005 and their results indicate that by increasing the degree of trade openness in these countries, the real exchange rate fluctuations decreases.
- Cociu (2007) has examined the impact of trade openness on real effective exchange rate fluctuations in eleven member-countries of Central and Eastern Europe during the period 1995-2006, and his results suggest that by increasing the degree of trade openness in these countries, the real exchange rate instability decreases.
- Hamori and Tanizaki (2004) have studied the sources of real exchange rate fluctuations in six African countries. The monthly data has been used in this study for the period 1990-2003. Results of this study indicate that real factors play a prominent role in the real exchange rate fluctuations, and the results also show that the floating exchange rate regime is as appropriate exchange regime in these countries.
- Juvenal (2009) has examined the role of monetary and non-monetary factors in explaining the behavior of the real exchange rate in America's economy by using a structural VAR model. In this research quarterly data over the period 2007-1976 has been used. His findings suggest that monetary factors are insignificant in explaining real exchange rate





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fluctuations. The results indicate also the real factors play an important role in explaining the behavior of the real exchange rate.

- Tayyebi and Zamani ((2012) have examined the relationship between the real exchange rate fluctuation and the degree of openness of the economy for 24 OECD countries and Iran during the period 1975-2009. The results suggest that openness of the economy adjust the exchange rate fluctuations in OECD countries, which often have floating exchange rate regime and the same results are also confirmed for Iran's economy, which has managed floating exchange rate regime.

- Abdolnaser Hemmati and Alireza Mobasherpour (2010) have investigated the impact of real and unreal shocks on real exchange rate fluctuations by using the structural VAR model and quarterly data during the period 1990-2008, and with assuming the constant nominal shocks in long term. The results show that real shocks play an important role in explaining the real exchange rate fluctuations. It also indicates that nominal shocks in the short term and long term can explain 53 and 39 percent of the nominal exchange rate fluctuations respectively, so using a stable monetary policy can reduce the real exchange rate fluctuations in the economy. Considering the importance of real shocks on the real exchange rate fluctuations, they also express the government can improve the competitiveness environment of the economy through increased productivity and efficiency by reducing the real exchange rate fluctuations

Econometric model and method

The estimation of model by using the generalized method of moments with dynamic panel data is one of appropriate econometric methods to eliminate or reduce the problem of endogeneity of the explanatory variables. Using GMM approach with dynamic panel data, has advantages such as considering individual variance anisotropy, more information and elimination of bias in the cross-sectional regressions, and its results is more accurate estimates with higher performance and less multicollinearity in GMM.

The GMM estimator, which is based on dynamic panel data models, is used in the equations, in which the fundamental problem is unobservable country-specific effects in their estimations and existence of dependent variables' lag in the explanatory variables. For estimating the model by using this method the instrumental variables used in the model should first be determined. GMM estimators' adaptation depends on the validity of the assumption of lack of serial correlation between disturbance and tools terms that can be tested by the tests specified by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998).

The first test is the Sargan test, which is one of predetermined limitations and tests the validity of the tools. The second test, is a statistic that tests the existence of second order serial correlation in first order differential disturbance terms. Failure to reject the null hypothesis of both tests, provide the evidence on the assumption of no serial correlation and validation of the tools. GMM estimator would be consistent if there is no second-order serial correlation in disturbance terms of first-order differential equation.

As previously mentioned, the estimated model is based on dynamic estimator in generalized method of moment (GMM), which its empirical framework is extracted from the model used by Baltagi (2007), which can be defined as follows:

$$y_{it} = \alpha y_{it-1} + \beta' x_{it} + \eta_i + \phi_t + \varepsilon_{it} \quad (1)$$

As y_{it} is the dependent variable and y_{it-1} is the dependent variable with on lag. Also x_{it} includes the independent variables, which are used under the instrumental variables and η_i is individual effects or fixed countries, ϕ_t is time fixed effects and ε_{it} is disturbance term. In the specified model (1), it is assumed that disturbance terms do not include correlations with the individual or fixed effects and with some of explanatory variables and the lagged values of





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dependent variable. Because, in this case, using the fixed effects method leads to biased estimators of the coefficients, and the above equation should be the first order differentiated. Thus we have:

$$\Delta y_{it} = \alpha \Delta y_{it-1} + \beta' \Delta x_{it} + \Delta \phi_t + \Delta \varepsilon_{it} \quad (2)$$

In the equation (2), first-order differentiating of the lagged dependent variable (Δy_{it-1}) was correlated with first-order differencing disturbance terms ($\Delta \varepsilon_{it}$) and also there exist the endogenous problem of the explanatory variables, which is not considered in the model. It is therefore necessary to use instrumental variables in the model to remove this problem. Therefore, following moment situation is hold for equation (2):

$$\begin{aligned} E(y_{it-s} \Delta \varepsilon_{it}) &= 0 & s \geq 2, t = 3, 4, \dots, T \\ E(x_{it-s} \Delta \varepsilon_{it}) &= 0 & s \geq 2, t = 3, 4, \dots, T \end{aligned}$$

To estimate the parameters of equation (2), the matrix of instrumental variables are used as follows:

$$z = \text{diag}(y_{12}, y_{13}, \dots, y_{1,t-2}, x_{12}, x_{13}, \dots, x_{1,t-2})$$

Therefore, the generalized method of moments' estimators, which is shown by $\hat{\delta}$, are defined as follows:

$$\hat{\delta} = (\beta' z' A_n z \beta')^{-1} \beta' z' A_n z Y$$

Then, after estimating the coefficients, Sargan test should be used to investigate the validity of the instrumental variables defined in the model and over-determination of the equation.

In this test, in case the null hypothesis is not rejected, the instrumental variables defined in the model is valid and the model does not need to define more instrumental variables. But, in case the null hypothesis is rejected, the defined instrumental variables are inadequate and inappropriate, and better instrument variables should be defined for the model (Baltagi, 2005).

In this paper, derived from the model of Obstfeld - Rogoff, the monetary and non-monetary factors are investigated with emphasis on the degree of openness of the economy on the real effective exchange rate fluctuations. The real exchange rate fluctuations is considered as the dependent variable and the degree of openness of the economy, the growth of labor productivity, liquidity growth, logarithm of net capital flows, logarithm of government expenditure and financial development are considered as independent variables. Accordingly, first the general model for economies BRICS countries will be specified as follows:

$$\text{LN}(\text{VREER}_{it}) = \alpha \text{LN}(\text{VREER}_{it-1}) + \beta \text{LN}(\text{OE}_{it}) + X_{it} \delta + Z_{it} \theta + \gamma (\text{OE}_{it} * X_{it}) + \eta_i + \varphi_t + \mu_{it}$$

In above model, $\text{LN}(\text{VREER}_{it})$ is logarithm of the real effective exchange rate conditional variance, $\text{LN}(\text{OE}_{it})$ is the logarithm of the degree of openness of the economy, X_{it} represents independent variables (liquidity growth, nominal growth of labor productivity, the logarithm of the ratio of government expenditure to Gross Domestic Product), Z_{it} represents Control variables (logarithm of financial development index, logarithm of exchange reserves and logarithm of net capital flows), $\text{LN}(\text{OE}_{it} * X_{it})$ is the interaction effects of the degree of openness of the economy with the independent variables, η_i is country fixed effects, φ_t is time fixed effects and μ_{it} is random error.

The model proposed by Engel ARCH (q) is the simplest model for the conditional variance of the effective real rate, in which the conditional variance is weighted mean of the square of forecast errors of the past, which means we have:





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$$h_t = \sigma_t^2 \left[\omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \right]$$

In which, σ_t is white noise process.Engel equation can be expanded as follows:

$$h_t = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^p \beta_i h_{t-i}$$

In which, h_t is the conditional variance of ε_t .Conventional conditional volatility form is GARCH (1,1) that is as follows:

$$h_t = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$

The criteria of Akaike (AIC) and Schwarz - Bayesian (SBC) have been used to obtain the most appropriate ARCH and GARCH model.To estimate the real effective exchange rate fluctuation index, first the reliability of the variable has been examined, then an adequate model for the real effective exchange rate behavior has been provided,and in next step, real effective exchange rate fluctuation has been obtained.

- Degree of openness will be achieved from the ratio of the sum of exports and imports (trade volume) to gross domestic product. $OP = \frac{EX+IM}{GDP}$

- Productivity growth is obtained from changes in per capita production of the employed labor, as follows: $Y_g = \Delta \left(\frac{GDP}{L} \right)$

In above equation, Y_g is productivity growth, GDP is gross domestic production and L is employed labor.

- In this paper M_2 changes, which includes currency and checking, demand deposits and time savings deposits, is used as growing liquidity.

- Financial development index (FD), actually indicates the financial resources in the form of loans and financing through monetary and banking sector, which are available for private sector, and it's also calculated through the ratio of funds allocated to the private sector to gross domestic product.

Estimation of the model

Specified model is estimated by using dynamic panel data (GMM) and time series data from 1995 to 2012. In this paper, data of the model has been collected from the database of the World Bank, the International Monetary Fund and United Nations Conference on Trade and Development.

The results of estimation are shown in Table 1.As it can be seen, the variables including logarithm of net capital flows and nominal money growth and quasi money have a positive and significant impact on the real effective exchange rate fluctuations.In other words, these variables cause deviation of real exchange rate from its long term equilibrium.For example, any capital flow into the country increases the demand for non-tradable goods and consequently it increases in non-tradable goods price and decreases the real exchange rate and causes its deviation from the long-run equilibrium rate.According to Dornbusch theory, nominal money growth leads to fluctuations in the exchange rate and deviation from its long term equilibrium path in the economies of BRICS countries, and the coefficient is significant at the 10% level.The impact of variables including the logarithm of financial development index and nominal growth of labor productivity on the real exchange rate fluctuation in the emerging economies called BRICS has been appeared contrary to theoretical expectations and it's not significant. The impact of the variable logarithm of foreign exchange reserves on the real exchange rate fluctuations is negative and significant at the 5% level.So that one percent increase in foreign exchange reserves leads to 0.37 percent decline in the real exchange rate fluctuations, assuming all other factors are constant. The reason of its negative impact is that the Central Bank avoid from the creation of any fluctuation in the exchange market, which is due to the shortage of



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exchange, if it has enough foreign exchange reserves. The ratio of government expenditure to gross domestic product can have a positive or negative effect on the real exchange rate fluctuations, so that if rising government expenditure increases domestic investment and strengthens the supply side, in this case, self-sufficiency of the domestic economy could lower the domestic needs of countries to the foreign economy in the economic sphere. In this paper for emerging economies called BRICS, the impact of logarithm of the ratio of government expenditure to gross domestic product on the real exchange rate fluctuations is significant at the level of 5% and one percent increase in it causes 14.51 percent reduction in the real exchange rate fluctuations, assuming all other factors are constant.

As expected, according to the theory Obstfeld - Rogoff (1996-1995) the effect of the degree of openness of the economy on the real exchange rate fluctuation is negative and significant at the level of 10%. So that one percent increase in the degree of openness of the economy leads to 8.005 percent reduction in real exchange rate fluctuations. Also interaction between money and quasi money nominal growth and the degree of openness of the economy on the real exchange rate fluctuations is negative and significant at the level of 10%. In fact, in the more open economies, the overall level of prices are more flexible and they provide a channel for faster reform of the domestic price level. So the domain of real effects of nominal and real shocks on the real exchange rate will be decreased. Closed economies are lack of more flexibility in the overall price level and therefore, by assuming other conditions are constant, the effects of shocks on the real exchange rate will be higher. In addition, interaction effect between the degree of openness of the economy and the ratio of government expenditure to gross domestic product on real exchange rate fluctuations is positive and significant, and its interaction effect with nominal growth of labor productivity on the real exchange rate fluctuations is insignificant.

a: coefficient significant at the level of 0.01, b: coefficient significant at the level of 0.05, c: coefficient significant at the level of 0.1 and d: coefficient significant at the level of over 0.1

- Numbers in parentheses are standard errors.

CONCLUSION

In this paper, the influence of some nominal and real factors on the real exchange rate fluctuations has been investigated in the economy of countries known as BRICS and the dynamic panel data econometric method (GMM) as an effective econometrics method has been used for the study of this issue in the article.

The results of this paper shows that in open economies, the sustainability of the strategy of openness of the economy helps to adjust exchange rate fluctuations. The findings of this research with are coincident with the theory of Obstfeld - Rogoff (1996-1995) and suggest that more open economies have the real exchange rate with less fluctuation. In fact open economies provide the channels for faster reform of the domestic overall price level and decrease any kind of money supply effects or real shocks on the real exchange rate. Closed economies with low flexibility of the general price due to the low contribution of imports are deprived this flexibility of transfers and the general price. Therefore by assuming the other conditions are constant, the effects of shocks are higher on real exchange rate. Also open economies usually use managed floating exchange regime and this regime is a deterrent to create monetary and currency crisis. Although developing countries may face with some costs in short term due to reforming trade policies and adopting open-door economic policies, but in the long term they will benefit from its interests to control monetary and currency crisis. Although in this paper, the impact of government expenditure on real exchange rate fluctuations was negative and significant, but more government intervention and outsourcing in the economy may have other negative consequences. Despite the negative impact of foreign exchange reserves of the Central Bank on the real exchange rate fluctuations, nowadays using the fixed exchange regime and controlling the exchange market by using exchange reserves, in the economy, is an outdated economic policy. Thus stabilizing the exchange market and protecting it from the negative consequences of exchange rate fluctuations, requires adopting an open door policy by economies.





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Table 1: Estimation results (dependent variable is the logarithm of the real effective exchange rate fluctuation)

Explanatory variables		The estimated coefficients
constant		27.787 c (16.0278)
LN(VREER_{it-1}) The lag of logarithm of the real exchange rate fluctuation		0.2371 b (0.09422)
LN(OP_{it}) logarithm of the degree of openness if the economy		-8.0058 c (4.134)
LN(CFN) Logarithm of net capital flows		0.277 c (0.1631)
LN(ER) Logarithm of foreign exchange reserves		-0.378 b (0.1595)
LN(FD) Logarithm of financial development index		0.6772 d (0.44629)
M_{2g} Nominal growth of money and quasi money		0.2648 c (0.1375)
LN(G/GDP) Logarithm of the ratio of government expenditure to gross domestic product		-14.51 b (6.156)
Y_g Nominal growth of productivity		-0.0759 d (0.0484)
Interaction term	M_{2g}*LN(OP_{it})	-0.06328 c (0.0341)
	LN(OP_{it})* LN(G)	3.728 b (1.55)
	Y_g*LN(OP_{it})	0.01330 d (0.01280)
Sargan test of over identifying restrictions H0: over identifying restrictions are valid Chi2(69)=75.01096 , prob>chi2=0.2898		



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Attention Please

About the Year of Light.....

On 20 December 2013, the UN General Assembly 68th Session proclaimed 2015 as the **International Year of Light and Light-based Technologies (IYL 2015)**.

OVERVIEWS AND AIMS

In proclaiming an International Year focusing on the topic of light science and its applications, the UN has recognized the importance of raising global awareness about how light-based technologies promote sustainable development and provide solutions to global challenges in energy, education, agriculture and health. Light plays a vital role in our daily lives and is an imperative cross-cutting discipline of science in the 21st century. It has revolutionized medicine, opened up international communication via the Internet, and continues to be central to linking cultural, economic and political aspects of the global society.



INTERNATIONAL
YEAR OF LIGHT
2015

IYL 2015 programs will promote improved public and political understanding of the central role of light in the modern world while also celebrating noteworthy anniversaries in 2015—from the first studies of optics 1,000 years ago to discoveries in optical communications that power the Internet today.

This International Year will bring together many different stakeholders including scientific societies and unions, educational institutions, technology platforms, non-profit organizations and private sector partners.

An International Year of Light is a tremendous opportunity to ensure that international policymakers and stakeholders are made aware of the problem-solving potential of light technology. We now have a unique opportunity to raise global awareness of this.

-John Dudley, Chairman of the IYL 2015 Steering Committee





Attention Please

International Year of Soils (IYS) 2015

The 68th UN General Assembly declared 2015 the International Year of Soils (IYS) (A/RES/68/232).



The Food and Agriculture Organization of the United Nations has been nominated to implement the IYS 2015, within the framework of the Global Soil Partnership and in collaboration with Governments and the secretariat of the United

Nations Convention to Combat Desertification.

The IYS 2015 aims to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions.

The specific objectives of the IYS 2015 are to:

- Raise full awareness among civil society and decision makers about the profound importance of soil for human life;
- Educate the public about the crucial role soil plays in food security, climate change adaptation and mitigation, essential ecosystem services, poverty alleviation and sustainable development;
- Support effective policies and actions for the sustainable management and protection of soil resources;
- Promote investment in sustainable soil management activities to develop and maintain healthy soils for different land users and population groups;
- Strengthen initiatives in connection with the SDG process (Sustainable Development Goals) and Post-2015 agenda;
- Advocate for rapid capacity enhancement for soil information collection and monitoring at all levels (global, regional and national).





RESEARCH ARTICLE

Effect of Supplementation of Herbal Choline on Serum Lipid Profile and Histopathology of Liver in of Broiler Chicken

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Received: 23 Mar 2015

Revised: 25 Apr 2015

Accepted: 28 May 2015

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ABSTRACT

A broiler trial was conducted for a period of 42 days to assess the efficacy of the natural herbal choline on the serum lipid profile of broilers. A total of 144 commercial broiler (Vencobb 400) day old chicks were divided into three treatment groups namely T1, T2 and T3 each group with six replicates of 8 birds per replicate. T1 group birds are fed with feed devoid of any choline (control), T2 group birds fed with synthetic choline (1kg/ton of feed) and T3 group birds fed with natural biocholine (1 kg/ton of feed). At the end of the trial, histopathological study of liver and intestine were carried out. Blood was collected from eight birds from each treatment and the total cholesterol, triglycerides, HDL and LDL were analyzed in serum. The serum total cholesterol was significantly reduced when compare to control. The HDL level (mg/dl) in T3 was found to be comparable between T2 and T1. Other parameters studied such as levels of triglycerides, LDL cholesterol, lipid content (%) of breast and thigh muscles did not differ significantly. The histopathological studies revealed that the liver of birds fed diets without choline had mild fatty infiltration and vascular changes in hepatocytes whereas in biocholine group any such changes were not observed. Similarly, normal and healthy intestinal villi were found in all the treatment groups. From the present study, it can be concluded that supplementation of herbal methionine @1.0 kg / ton of broiler diet resulted in comparable biochemical parameters when compared with control.

Key words: Synthetic choline, herbal choline, LDL, HDL, triglycerides



**Kathirvelan and Purushothaman****INTRODUCTION**

Choline is an essential component of vitamin B-complex for poultry. Supplementation of choline in poultry ration is well established to improve growth, performance and to regulate lipid metabolism (Attia *et al.*, 2005). Research studies indicate that supplementation of choline in ration is essential to prevent fatty liver syndrome by regulating lipid metabolism (Schrama & Gratis, 2000). It has three chemically reactive methyl groups attached to nitrogen atom of glycine molecule. Therefore it can be used as a methyl donor partially to replace methionine in poultry and pigs. In poultry, methyl group of choline is available after conversion into betaine in liver.

Choline has an energy sparing role by reducing maintenance requirement and thus improving overall growth and productivity (Schrama and Gratis, 2000). Efforts to replace synthetic vitamins and enzymes by herbal preparations are always being made through research to avoid the side effects of them in livestock and poultry. It has been recorded that herbal products improved performance and carcass characteristics in broilers (Jadhav *et al.*, 2004). Herbal liver preparations have been found much beneficial in not merely counteracting the ill effects of toxic principles in poultry feed but also acted as performance promoters (Narahari, 1992). Daljeet kaur *et al.*, (2007) observed significantly ($P < 0.05$) better body weight, FCR, energy and protein utilization and superior immune status in broiler chickens with supplementation of herbal methionine and choline. Hence, this research was carried out to study the impact of herbal choline supplementation on the serum lipid profile and muscle and liver lipid deposition of broilers as an alternative to synthetic choline.

MATERIALS AND METHODS

The experiment was conducted on 144 numbers of day-old Vencobb straight run broilers chicks for a period of six weeks. The chicks were weighed individually; wing banded and distributed randomly into three treatment groups namely T1, T2 and T3 having six replicates of 8 birds per replicate. T1 group birds are fed with feed without choline, T2 group birds fed with synthetic choline (1kg/ton of feed) and T3 group birds fed with herbal biocholine (1 kg/ton of feed) (Table 1). All the diets were formulated to achieve isocaloric and isonitrogenic (The ingredients used for preparation of experimental rations (Table 1) were analyzed for protein as per AOAC, 1995). The birds were fed the prestarter, starter and finisher diets for day 1 to 14, 15 to 28 and 29 to 42 days of age respectively. The birds were housed in deep litter pens using coconut coir pith as litter material and reared from day-old to 42 days of age following standard management practices. Feed and water were provided *ad-libitum*. All the birds were vaccinated against Ranikhet disease on 7th day and IBD on 14th day of age.

At the end of the trial, eight birds were slaughtered from each treatment group to study the serum and muscle lipid profile. The total lipid was extracted from breast muscle as per the method suggested by Folch *et al.* (1957) and total cholesterol was estimated by one-step method of Wybenga *et al.* (1970). The intestinal and liver tissue was subjected to histopathological studies to study the intestinal villi and liver health status. The data collected on various parameters were statistically analyzed as per the methods of Snedecor and Cochran (1989) and the means of different experimental groups were tested for statistical significance by Duncan's multiple range test (Duncan, 1995).

RESULTS AND DISCUSSION

The serum and muscle lipid profile is depicted in Table 2. The serum total cholesterol was reduced in T3 (113.77 mg/dl) when compare to T2 (120.86 mg/dl) and T1 (126.39 mg/dl). The HDL level (mg/dl) in T1, T2 and T3 was 54.15, 57.34 and 55.50 mg/dl respectively and T3 found to be comparable between T2 and T1. The serum total cholesterol,



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HDL was found to be comparable between herbal and synthetic choline fed groups. Other parameters studied such as levels of triglycerides, LDL cholesterol, lipid content (%) of liver and breast and thigh muscles did not differ significantly. Jadav *et al.*, 2008, reported that supplementation of herbal choline in the broiler diet significantly contributed in reducing cholesterol, triglycerides & regulating the fat metabolism in broilers in addition to improvement in growth performance & other haematobiochemical parameters. Kaviarasan *et al.* (2007) also reported similar hypocholesterolemic and lipid lowering activities of some herbs in experimental chicken models. Kulinski *et al.*, (2004), reported that deficiency of choline in ration exerts a hypercholesterolemic effect inhibiting the phosphatidylcholine synthesis in hepatocytes, thus causing fatty liver. Gangane *et al.*, 2010, reported that diets without supplementation of choline or herbal source, there was not complete protection to the liver. Similarly, Lambardi *et al.*, 1968 reported that choline deficient rats suffered from fatty liver due to an impaired release of hepatic triglycerides into plasma indicating the role of choline in regulating lipid metabolism.

The histopathological studies revealed that the liver of birds fed diets without choline had mild fatty infiltration and vascular changes in hepatocytes (Fig 1) whereas in biocholine group (T2) any such changes (Fig 2) were not observed. Similarly, normal and healthy intestinal villi were found in all the treatment groups (Fig 3 and Fig 4). This reveals that herbal choline supplementation didn't have any deleterious effect on the health of the birds. Similar result was reported by Kanduri *et al.*, (2013) reported that supplementation of herbal or synthetic amino acids were devoid of lesions and completely normal when compare to control.

From the present study, it can be concluded that supplementation of herbal choline @1.0 kg / ton of broiler diet resulted in comparable biochemical parameters when compare to control. Hence this study concludes that herbal choline can effectively replace synthetic choline to improve the performance.

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Table 1. Ingredient (%) and proximate composition of the broiler pre starter, starter and finisher rations

Feed Ingredients (%)	Pre-starter	Starter	Finisher
Maize	55.10	56.30	61.80
Soybean meal	39.50	37.20	30.7
Salt	0.29	0.30	0.30
Rice Bran Oil	1.80	3.10	4.20
Calcite	1.70	1.70	1.67
Di-Calcium Phosphate (DCP)	1.00	0.90	0.90
Additives (%)			
NSP degrading enzyme	0.05	0.05	0.05
Phytase	0.02	0.02	0.02
DL-Methionine	0.26	0.27	0.24
Lysine	0.158	0.162	0.177
Threonine	0.012	0.023	0.034
Sodium bicarbonate	0.144	0.066	0.051
Trace mineral mixture	0.200	0.200	0.200
Toxin binder	0.05	0.05	0.05
Vitamin premix	0.100	0.100	0.100
Salinomycin	0.05	0.05	0.05
Anti-oxidant	0.01	0.01	0.01
Vitamin E 50 %	0.010	0.008	0.005
Emulsifier	0.05	0.05	0.05





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Livertonic	0.10	0.10	0.10
Grand Total	100	100	100
Proximate composition and ME			
Dry matter (%)	91.30	90.93	91.74
Crude protein (%)	22.49	21.51	19.45
Crude fibre (%)	3.54	3.26	3.14
Ether extract (%)	4.25	5.42	6.95
Total ash (%)	7.91	7.75	7.62
Nitrogen free extract (%)	53.11	52.99	54.58
Metabolisable energy (kcal/kg)	3,000	3,100	3,200

Table 2. Serum and muscle lipid profile (liver and muscle) of birds fed with herbal and synthetic choline.

Attribute	Control (T1)	Synthetic choline (T2)	Herbal choline (T3)
Total cholesterol (mg/dl)	126.39 ^c ± 3.75	120.86 ^b ± 2.20	113.77 ^a ± 3.51
Triglycerides (mg/dl)	21.14 ± 0.45	20.31 ± 0.76	20.56 ± 0.63
HDL (mg/dl)	54.15 ^a ± 1.30	57.34 ^b ± 0.70	55.50 ^{ab} ± 1.79
LDL (mg/dl)	68.01 ^c ± 6.02	52.37 ^a ± 5.67	61.25 ^b ± 5.92
Liver lipid (%)	7.15 ± 0.37	5.87 ± 0.50	6.14 ± 0.28
Breast muscle lipid (%)	1.23 ± 0.09	1.28 ± 0.54	1.13 ± 0.32
Thigh muscle lipid (%)	2.39 ± 0.37	2.21 ± 0.16	2.25 ± 0.21

Mean ± SE of eight observations

Values bearing different superscript in a column differ significantly at (P<0.05)





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Histopathological pattern of birds fed with herbal and synthetic choline

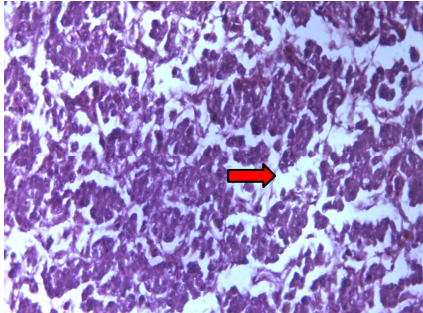


Fig.1. Control group (without choline) – Diffuse mild vascular changes in hepatocytes. Arrow – Fatty degeneration in hepatocytes

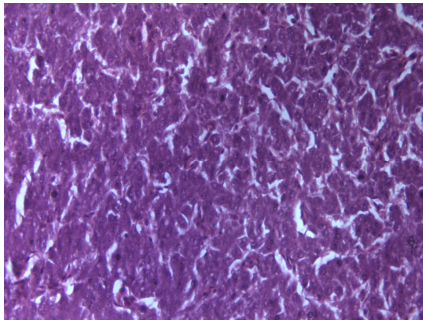


Fig.2. Herbal choline group – No changes in liver hepatocytes

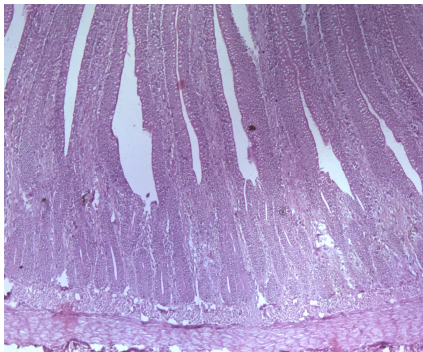


Fig.3. Control group - Normal and healthy intestinal villi

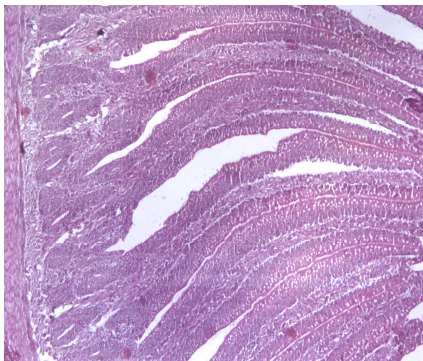


Fig.4. Herbal choline group – Normal and healthy intestinal villi comparable with control group.





Hematological and Biochemical Profiles of Malabari Pre-weaner Kids fed Different Creep Rations

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Received: 24 Mar 2015

Revised: 23 Apr 2015

Accepted: 29 May 2015

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ABSTRACT

An investigation was carried out in Malabari preweaner kids, to study the response of haematological and biochemical blood parameters to creep ration supplemented with conventional feed ingredient (CR-1) and creep ration supplemented with poultry carcass meal (CR-2) during the pre-weaning period (2-12 weeks). The hematological and biochemical profile were analysed at 2nd week and at 12th week. Though Hb, TEC, and PCV were significantly ($P<0.05$) different at 2nd week, at 12th week there was no difference. TLC count was found statistically different in all three groups at 2nd and 12th week. MCV and MCH were found statistically different in all three groups at 2nd and 12th week, but there was no significant difference found in values of MCHC in all the three groups. Though the levels of blood urea nitrogen (BUN) at 2nd week was significantly ($P<0.05$) higher in T₂, at 12th week the BUN level was high in T₃ group followed by T₂ group due to high proteinacious creep ration.

Key words: Haematological profile, Biochemical blood profile, Malabari kids.

INTRODUCTION

The elixir of life is blood and it is useful for assessing the health status, physiological, pathological conditions and can also be used for diagnostic and prognostic evaluation of various types of diseases in animals. It also helps in



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distinguishing state of stress, which can be maturational, environmental or physical (Aderemi, 2004). The hematological indices can reflect on the effects of dietary treatment on the animals in terms of the type and amount of feed ingested and also the level of anti-nutritional factors present in the feed (Akinmutimi, 2004). Metabolic changes may alter the range of blood constituents and reflect the influence of physiological stress (Al-Eissa et al., 2012). Therefore, the reported study was conducted to find out the effects of two types of creep ration on the haematological and biochemical profiles of Malabari pre-weaner kids.

MATERIALS AND METHODS

The experiment was carried out on eighteen pre-weaned Malabari kids of uniform morphological characters along with their does. The eighteen kids were randomly allocated to three treatments (T₁, T₂ and T₃). The animals in treatment I (T₁) were considered as control group. Does of T₁ were allowed to suckle their kids till 12 weeks. Does were fed concentrate mixture containing 14% DCP and 70% TDN (IS. 2052. 2012). Green grass/tree leaves were also provided *ad libitum*. In treatment II (T₂), along with natural suckling, kids were fed formulated Creep Ration-1 (CR-1) containing 17% DCP and 70% TDN as per IS. 5569. 1970, incorporated with soya bean and gingelly oil cake as the main protein source from 2nd week till 12th week. Green grass/tree leaves were also provided *ad libitum*. In treatment III (T₃), in addition to natural suckling, the kids were fed with formulated creep ration -2 (CR-2) containing 17% DCP and 70% TDN as per IS. 5569. 1970, incorporated with poultry carcass meal as the main protein source replacing gingelly oil cake and soybean cake in ration-I Tree leaves /grasses were also provided *ad-libitum* to stimulate rumen development.

Blood samples were collected in EDTA impregnated tube at 2nd week and 12th week of experiment from each animal by puncturing the jugular vein. Total erythrocytic count (TEC), hemoglobin (Hb) concentration, Total leucocytic count (TLC) and packed cell volume (PCV) were estimated using standard procedure described by Schalm, (1986). The WBC and RBC counts were estimated by automated hematology analyzer. Mean Corpuscular Hemoglobin Concentration (MCHC), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Volume (MCV) values were calculated by using formula described by Jain, (1986).

The biochemical assessment viz. glucose, total protein, creatinine and blood urea nitrogen were estimated from blood serum. Commercial kits® and standard protocols by spectrophotometry were used for estimation of biochemical parameters. Serum Glucose was estimated by Glucose Oxidase method (GOD) (Tiez, 1976). Serum total protein (TP) by Biuret method (Dumas *et al.*, 1971). Creatinine content in the serum was determined by the alkaline picrate method of Bonses and Taussky (1945) and serum urea was determined by diacetylmono-oxime (DAM) method (Wybenga *et al.*, 1971). Data pertaining to the in-vitro studies were statistically analyzed using randomized block design (RBD) with one-way ANOVA (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The results of hematological and biochemical profile of pre-weaner Malabari kids are presented in (Table 1).

Haematological profiles

The level of haemoglobin and PCV was significantly different at 2nd week but there was no significant difference between the groups at 12th week. It indicates that the nutrient requirements were adequately met and there was no parasitic disease. The TEC count among various treatment group was not significantly different at 2nd week but there was significantly high in T₁ (P< 0.05) at 12th week indicating its access to soil. The TLC count among the various treatment groups was significantly different at 2nd and 12th week which might be due to subclinical infections. The



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levels of MCV, MCH and MCHC was not significantly different at 2nd and 12th week. MCV, MCH and MCHC are almost similar to values for adult Malabari goat obtained by Rejitha and Karthiayini (2014). It indicates that there was no ill effect of poultry carcass meal (unconventional feed source) on the health of kids.

Biochemical profiles

The levels of blood glucose at 2nd week in T₂ and T₃ group were higher compare to T₁ group. But there was no significant difference between the groups at 12th week. The values are similar to the values obtained by Chaturvedi *et al.* (2013) in Barbari goat. The level of total protein among various treatment groups was not significantly different at 2nd week. But there was significant (P<0.05) difference at 12th week. Moreover, the total protein level at 12th week was more in T₃ group followed by T₂ group compared to T₁ group. The increased levels of total protein in T₃ group at 12th week could be due to supply of more rumen undegradable protein to these groups from poultry carcass meal. The levels of creatinine at 2nd week in T₂ and T₃ group were higher compare to T₁ group. But at 12th week the level of creatinine was higher in T₃ followed by T₂ and T₁. Chaturvedi *et al.* (2013) had reported similar values in Barbari goats.

The level of BUN among various treatment groups was significantly (P<0.05) different. Moreover, the BUN level at 2nd week was more in T₂ group followed by T₁ and T₃ group. At 12th week the BUN level was more in T₃ group followed by T₂ group compared to T₁ group. The increased levels of BUN in T₃ group at 12th week could be due to supply of more rumen undegradable animal protein to these groups. This result is similar to the findings of Sarwar *et al.* (2010) who reported that there was linear increase in BUN level when the CP of feed was increased. The additional protein supplied through concentrate feed might have increased the BUN values through metabolism.

CONCLUSION

Based on the results obtained in the present study, it is concluded that there is no significant influence of creep feeding on the haematological profiles of Malabari kids. But the effect of feeding high protein diet (rumen degradable in CR-1 and rumen undegradable in CR-2) creep ration is reflected in the blood biochemical parameters of Total Protein and BUN.

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Table .I Haematological and biochemical Profiles of Malabari kids at 2nd week and 12th week

Hematological parameters	2 nd week		
	T ₁	T ₂	T ₃
Hemoglobin (g/dL)	7.3 ± 0.24 ^a	7.9 ± 0.29 ^b	7.8 ± 0.12 ^b
PCV (%)	22.1 ± 0.74 ^a	23.8 ± 0.88 ^b	23.65 ± 0.37 ^b
TEC (x 10 ⁶ /μL)	9.33 ± 0.67	9.83 ± 0.60	9.0 ± 0.36
TLC (x 10 ³ /μL)	7.5 ± 0.42 ^b	8.3 ± 0.42 ^a	7.83 ± 0.30 ^b
MCV (fl) (10 ⁻⁴)	24.0 ± 0.00 ^b	24.0 ± 0.00 ^b	26.0 ± 0.00 ^a
MCH (pg) (x 10 ⁻⁵)	8.1 ± 0.02 ^b	8.1 ± 0.02 ^b	8.7 ± 0.02 ^a
MCHC (g %)	33.33 ± 0.0 ^{ns}	33.33 ± 0.0 ^{ns}	33.33 ± 0.0 ^{ns}
Blood Glucose (mg/dL)	31.37 ± 0.41 ^b	33.91 ± 0.74 ^a	33.91 ± 0.53 ^a
Total protein (g/dL)	8.57 ± 0.20 ^{ns}	8.65 ± 0.2 ^{ns}	8.97 ± 0.18 ^{ns}
Serum creatinine (mg/dL)	0.52 ± 0.00 ^b	0.55 ± 0.01 ^a	0.55 ± 0.01 ^a
BUN (mg/dL)	48.66 ± 0.49 ^b	52.21 ± 0.42 ^a	49.52 ± 0.69 ^b
12 th week			
Hemoglobin (g/dL)	8.4 ± 0.25	8.4 ± 0.20	8.4 ± 0.23
PCV (%)	25.3 ± 0.76	25.45 ± 0.62	25.1 ± 0.69
TEC (x 10 ⁶ /μL)	11.83 ± 0.74 ^a	10.0 ± 0.33 ^b	10.0 ± 0.44 ^b
TLC (x 10 ³ /μL)	8.33 ± 0.33 ^a	8.67 ± 0.56 ^a	7.5 ± 0.42 ^b
MCV (fl) (10 ⁻⁴)	21.0 ± 0.01 ^c	23.0 ± 0.00 ^b	25.0 ± 0.00 ^a
MCH (pg) (x 10 ⁻⁵)	7.3 ± 0.02 ^b	8.0 ± 0.01 ^b	8.4 ± 0.02 ^a
MCHC (g %)	33.33 ± 0.0 ^{ns}	33.33 ± 0.0 ^{ns}	33.33 ± 0.0 ^{ns}
Blood Glucose (mg/dL)	37.94 ± 0.49	36.94 ± 0.81	37.13 ± 0.27
Total protein (g/dL)	11.93 ± 0.31 ^c	14.23 ± 0.30 ^b	18.73 ± 0.37 ^a
Serum creatinine (mg/dL)	0.57 ± 0.00 ^a	0.57 ± 0.00 ^a	0.65 ± 0.00 ^b
BUN (mg/dL)	52.95 ± 0.50 ^b	56.42 ± 0.64 ^a	57.24 ± 0.90 ^a

Means with different superscripts in a row differ significantly at P <0.05





RESEARCH ARTICLE

Identification of Oestrus Specific Pheromones in Crossbred Dairy Cattle of High Range Zone

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Received: 26 Mar 2015

Revised: 28 Apr 2015

Accepted: 29 May 2015

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ABSTRACT

Pheromones play a major role in animal communication and the role of pheromones play in signaling the state of estrus. The ability to efficiently detect estrus is becoming increasingly important, especially in the management of dairy cattle, where artificial insemination is used extensively. The understanding of pheromones may eventually provide a solution to this problem. The purpose of this study was to identify the oestrus specific pheromones in the urine of crossbred dairy cattle. The location of study is endowed with humid climate with maximum rain fall by south west monsoon from June to September and north east monsoon from October to November. The experiment was carried out on eighteen crossbred cows with uniform body weight and morphological characters. The experimental animals were fed with the feed formulated in Instructional Livestock Farm Complex, College of Veterinary and Animal Sciences, Pookode. All experimental animal were maintained under same feeding pattern. During the study period, urine samples were collected in the morning, noon and evening during oestrus stage. Urine samples were collected either during spontaneous or manually induced urination. The samples are filtered and is stored in air tight glass bottles. The test substances were stored at -20°C until used. The urine was extracted with Di Chloromethane and the extract analyzed by gas chromatography and mass spectrophotometry.



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Results indicate that oestrus specific compounds viz Tetradecamethyl-Cycloheptasiloxane, 3,5-bis(1,1-dimethylethyl)-Phenol, 1-Iodoundecane, Tetradecanoic acid, Octadecamethyl-Cyclononasiloxane, 2-methylhexacosane and (5.alpha.)-Androstane were identified during estrus. It can be concluded that identified oestrus specific pheromones in crossbred dairy cattle would be useful to determine the optimum time for insemination of an animal in sub-estrus since no heat signs are observed.

Key words: Oestrus cycle, Crossbred dairy cattle, Pheromones

INTRODUCTION

Cattle farming is an inseparable and integrated part of small holder subsistence farming system in India. Dairy farming underwent great changes during the 20th century, developing into a regular industry. In India cattle contributes 37.28% of the total livestock contributing about 38% of total milk production (19th Livestock Census). At the same time decreasing fertility rates is of prime concern to the developing dairy industry in India. Although India is a major producer of livestock products the average productivity of livestock is lower compared to world average. Inadequate coverage through artificial insemination, low conception rates, non-availability of quality males for breeding and poor breeding management practices are attributed as reasons for this (NLP 2013). The declining reproductive performance is partly attributable to metabolic stress induced by milk production (Dobson *et al.*, 2007) and partly to the negative genetic correlation that exists between milk yield and fertility (Pryce *et al.*, 2004). Declining dairy cow fertility, largely attributable to increasing milk yields, is also a major concern to dairy farmers worldwide.

One of the underlying mechanisms of the decreased fertility rates is displaced or depressed dairy cow oestrous behavior, which makes it hard for farmers to determine the optimal time for artificial insemination (AI) (Dobson *et al.*, 2008). The performance of herd in general and female in particular depend on how female animals being noticed in heat and when they are offered A.I. Lacunae in the system of heat detection at any level ultimately leads to production loss (Kariret *et al.*, 2006). Even though different visual heat detection techniques has been developed certain factors such as breed, light, season, parity, hormonal balance, body condition, management and production engender poor manifestation of estrus signs which makes visual estrus detection difficult. Proper heat detection to achieve appropriate timing of insemination is the biggest restriction in attaining high conception rate in dairy herd.

Chemical signals play a major role in mammalian reproduction and behavior. The pheromone signals are known to have a crucial role in animal reproduction and reproductive management (Archunan 2009; Buck 2000; Dominic 1991; Rekwoet *et al.* 2001; Tirindelliet *al.* 2009). The animal releases volatile odors into the surrounding atmosphere, most of which are waste products of metabolism in which emission of some compounds closely related to reproductive activities are termed as chemical signals (Hradecky, 1975). These chemical signals have been reported to be volatile and nonvolatile molecules that are perceived through the main or accessory olfactory system (Brennan and Keverne 1997; Tirindelliet *al.* 1998).

One of major problems in detecting estrus in dairy cattle is the absence of reliable estrus signs especially in conditions such as silent heat which is common among crossbred dairy cattle. Unlike in the normal condition, visual signs of estrus are not prominent in the cattle with silent heat. The understanding of pheromones may eventually provide a solution to this problem. Therefore, the objective of this study is to identify oestrus specific pheromones in the urine of crossbred dairy cattle.



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MATERIALS AND METHODS

The study was carried out at the Cattle farm unit, Instructional Livestock Farm Complex, College of Veterinary and Animal Sciences, Pookode, Wayanad. Which is situated at 11° 32' 18.5 (North) longitude and 76° 01' 14.15 (East) latitude, at an altitude of 867 m above the mean sea level. The location of study is endowed with humid climate with maximum rain fall by south west monsoon from June to September and north east monsoon from October to November.

Experimental animals

The experiment was carried out on eighteen crossbred, cattle with almost uniform body weight and observed for visual estrus signs. The animals were maintained at Instructional livestock farm complex, College of veterinary and Animal Sciences, Pookode, Wayanad and fed with conventional diet (cultivated forage crops, concentrates, supplemented with a little green fodder). All the animals were housed in a well-ventilated shed with double monitor system of ventilation and arrangement for individual feeding; clear and fresh drinking water was made available to all the animals throughout the day. Strict managerial and hygienic practices were adopted throughout the period of study.

Oestrus detection

Visual oestrus detection was performed twice daily until the onset of oestrus. To evaluate duration of oestrus and the strength of display as objectively as possible, the animals were observed in a standardized manner with five signs of oestrus being evaluated and scored (body position at the beginning of the observation, degree of restlessness, occurrence of lordosis, presence of vaginal discharge and appearance of the external genitalia).

Rectal palpation

The animals observed to be in estrus during visual observation is confirmed by rectal palpation. Tonicity of uterus, curling of uterine horns etc.

Identification of bioactive compounds

Sample collection

Oestrous urine is collected three times at three hourly intervals. Urine samples were collected either during spontaneous or manually induced urination. The samples are filtered and are stored in air tight glass bottles. The test substances were stored at -20°C until used.

Sample processing

Sample processing was done prior to chemical analysis. Test samples stored at -20°C is thawed to room temperature to mobilize the volatiles. Samples from each stages (pre, pro and estrus) were pooled to minimize individual variation. 5 ml triplets of each sample of three stages are made after thorough mixing. Then an equal amount of DCM (5 ml) is added to the samples to extract the volatiles. Urine samples with DCM in the ratio 1:1 is then centrifuged for 20 min at 5000 rpm under 15°C to increase the yield of volatiles. After centrifugation the supernatant layer is discarded to retrieve the volatile layer. The volatile layer containing the DCM and volatiles from urine is then cooled below 20°C to reduce the loss of volatiles during handling. The volatiles are then treated with Sodium sulfate to remove any water molecules before loading in to GC-MS. Fragmentation and chemical identification by Gas Chromatography Mass Spectrometry was done in GC-MS; QP-2010, Shimadzu, Japan. Two micro litres of extract was injected into the GC-MS analyzer on a 30m glass capillary column with a film thickness of 0.25µm and diameter



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0.25mm (30m, id RXI 5Si LMS) using the following temperature programme: initial oven temperature of 40°C for 4 min, increasing to 250°C at 15°C / min, and then held at 250°C for 10min the final temperature was 280°C for 1 min. The MS detection was performed at 70 eV ionization energy. Carrier gas was helium and flow rate was set at 1.0 mL/min. The mode of injection was splitless. Ion source and MS interface temperature were set at 200°C and 100°C, respectively. Different volatile compounds with detectable peaks are identified (Plate 1). Identifications are then confirmed by comparing the retention time of the compound to be identified with that of an authentic standard.

RESULTS

The identified oestrous specific pheromones in crossbred cattle is depicted in Table.1, Plate.1 and Fig.1 Seven different oestrous specific compounds viz. Tetradecamethyl-cycloheptasiloxane (Fig.1a), 3, 5-bis (1, 1-dimethylethyl)-phenol (Fig.1c), 1-Iodoundecane (Fig.1g), tetradecanoic acid (Fig.1e), Octadecamethyl-cyclononasiloxane (Fig.1b), 2-methylhexacosane (Fig.1d) and (5.alpha.)-androstane (Fig.1f). The other compounds tetradecanoic acid, 2-methylhexacosane, 3, 5-bis (1, 1-dimethylethyl)-phenol and (5.alpha.)-Androstane are first report to be present in crossbred dairy cattle.

DISCUSSION

Identification of oestrus specific compounds in crossbred dairy cattle urine can lead to efficient and accurate detection of oestrus especially in cases like sub-estrum. However information on biological potential of volatile compounds in crossbred cattle urine is scanty. Hence an investigation has been carried out to identify oestrus specific volatile compounds in urine of crossbred cattle.

Extraction of volatile compounds

The extraction procedure adopted for the present study is refrigerated centrifugation at 5000 rpm for 20 minutes under 15°C. The results obtained from GC-MS analysis clearly suggests that the procedure is successful in eluting the urinary volatiles. Total of 35 volatile compounds were identified in the present study. The number of compounds obtained in the present study is higher than the number of compounds obtained by Ramesh Kumar *et al.* (2000) in cow urine.

Oestrus specific pheromones in crossbred dairy cattle

Oestrus specific, volatiles or pheromones have potential role in animal reproduction and management. Urinary volatiles identified from different stages of oestrus cycle in crossbred dairy cattle revealed seven different oestrus specific compounds viz., Tetradecamethyl-cycloheptasiloxane, 3,5-bis(1,1-dimethylethyl)-phenol, 1-Iodoundecane, tetradecanoic acid, Octadecamethyl-cyclononasiloxane, 2-methylhexacosane and (5.alpha.)-Androstane. Among these 1-iodoundecane has been reported to be oestrus specific in *Bos Taurus* by Archunan and Ramesh Kumar (2012). Whereas the presence of other compounds tetradecanoic acid, 2-methylhexacosane, 3, 5-bis (1, 1-dimethylethyl)-Phenol and (5.alpha.)-Androstane are reported for the first time in cattle urine. Since the natural oestrous cycle is caused by hormonal changes, the presence of hormone analogues in urine is also be caused by endocrinal changes. The endocrinal dependence of some urinary volatile compounds has been reported in mice (Schwende *et al.*, 1984; Jemiolo *et al.*, 1987) and in cows (Denhardt *et al.*, 1991).

The compound tetradecanoic acid has been reported in buffalo urine by Rajanarayanan and Archunan, (2011) in pro-estrus and oestrus stage of oestrus cycle. 2-methylhexacosane another important compound identified to be oestrus specific in the present study was reported to be the first contact pheromone in long horn beetle by Spikes *et al.*, 2010. The other compounds 3, 5-bis (1, 1-dimethylethyl)-Phenol and (5.alpha.)-Androstane are urinary volatiles present in





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mice (Cavaggioni *et al.*, 2006). Tetradecamethyl-cycloheptasiloxane and Octadecamethyl-cyclononasiloxane are considered as contaminants because both the compounds are Non-ionic silicone surfactants that may be derived from laboratory contamination or from containers in which the urine is frequently collected or processed. From the study, it can be concluded that identified oestrus specific pheromones in crossbred dairy cattle would be useful to determine the optimum time for insemination of an animal in sub-estrus since no heat signs are observed.

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Table 1-Oestrus Specific pheromones in crossbred dairy cattle

S. No.	Name of the compound	Molecular weight	Molecular formula
1	Tetradecamethyl-Cycloheptasiloxane	519.07	C ₁₄ H ₄₂ O ₇ Si ₇
2	3,5-bis(1,1-dimethylethyl)-Phenol	206.32	C ₁₄ H ₂₂ O
3	1-Iodoundecane	282.20	C ₁₁ H ₂₃ I
4	Tetradecanoic acid	228.37	C ₁₄ H ₂₈ O ₂
5	Octadecamethyl-Cyclononasiloxane	667.38	C ₁₈ H ₅₄ O ₉ Si ₉
6	(5.alpha.)-Androstane	260.46	C ₁₉ H ₃₂
7	2-methylhexacosane	380.73	C ₂₇ H ₅₆

Chromatogram of oestrus specific pheromones in crossbred dairy cattle

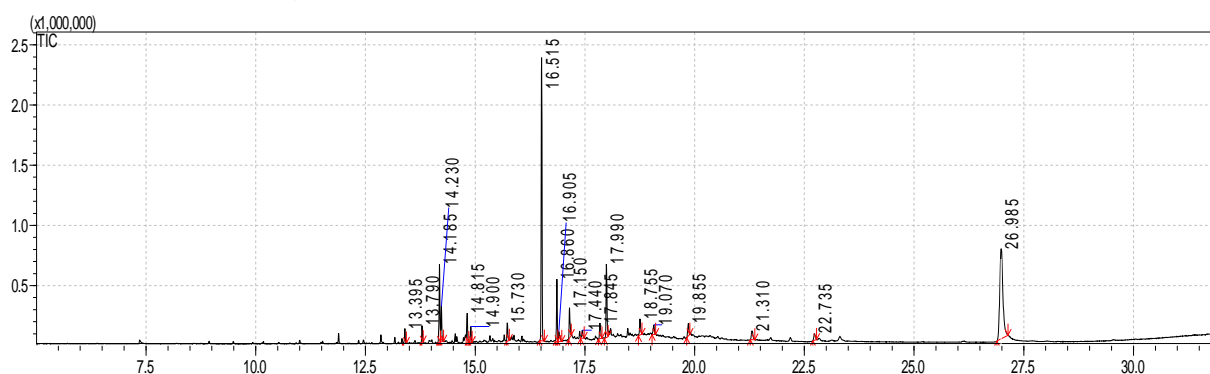


Fig.1 Structure of oestrus specific pheromones

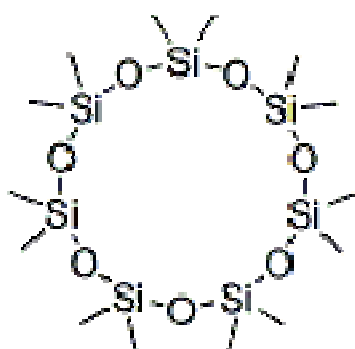


Fig.1 a Tetradecamethyl-Cycloheptasiloxane

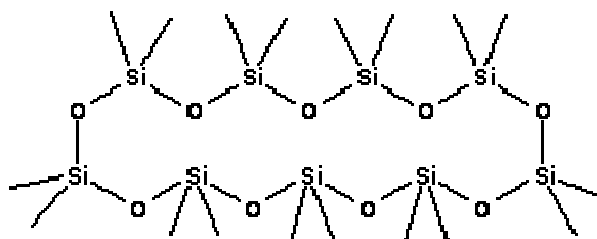


Fig.1 b-Octadecamethyl-Cyclononasiloxane





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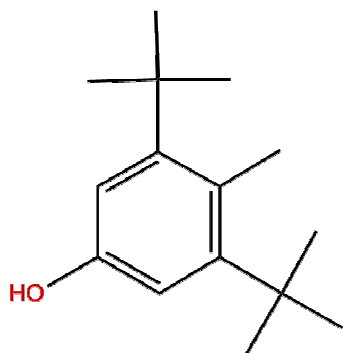


Fig.1 c- 3,5-bis(1,1-dimethylethyl)-Phenol

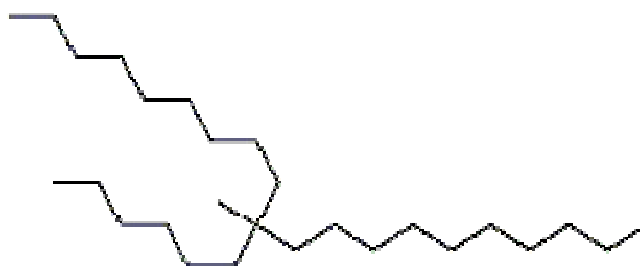


Fig.1 d-2-methylhexacosane



Fig.1 e-Tetradecanoic acid

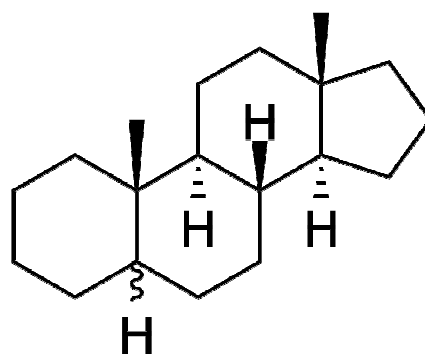


Fig.1 f-(5.alpha.)-Androstane



Fig.1 g-1-iodoundecane





RESEARCH ARTICLE

Effect of Nutritional Flushing on the Reproductive Performance of Malabari Does

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Received: 22 Mar 2015

Revised: 26 Apr 2015

Accepted: 29 May 2015

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ABSTRACT

A total of 20 Malabari does were randomly divided into two groups of 10 each into T₁ and T₂. The does of the two groups were on natural grazing (Congo signal grass) from 8.00 am to 11.00 am. All the does were provided with potable water and ad-libitum supply of Jack fruit leaves. The T₂ does were flushed with concentrate feed (18% DCP and 70%TDN) at the rate of 250g per animal from two weeks prior to breeding. The conception rate and kidding rate were 20% higher in flushed does as compared to that of non-flushed. Twinning rate was 90 % in T₂ and 80 % in control group T₁. This indicates that the flushing had a positive effect on the reproductive performance of Malabari does managed under semi-intensive system.

Key words: Flushing, Reproductive performance, Malabari.

INTRODUCTION

Goat farming has gained more importance recently as "future Animal" for rural prosperity. Small ruminant sustenance farming is practiced in tropics as a means for efficiently utilizing production potential of animals combined with their ability to adapt efficiently to changing agro-climatic conditions. There are over 880 million goats



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around the world out of which India has over 126 million which makes it at second position (FAOSTAT, 2008). As per the 19th Livestock census, goat population declined by 3.82% over the previous census. The decline in goat population is partly attributed to reproductive problems associated with nutritional deficiencies which stress the need for developing different management tools, especially for reproduction and nutritional management for indigenous breeds.

Malabaribreed of Kerala is well known for its prolificacy in breeding and better adaptability to tropical climates. Twinning's and triplets once common among this breed is now found to be diminishing due to nutritional deficiencies. Among the various causes, it has been found that ovulation and pregnancy rates are reduced due to undernourishment of females (Abecia *et al.*, 2006). Under grazing condition, goats should be supplemented with concentrated feed to cover their nutritional requirements (Martin and Kadokawa *et al.*, 2006).

Flushing is a common practice to improve the reproductive efficiency of different species. This practice consists of increasing the level of energy offered prior to mating until 21 days (Luginbuhl and Poore 1998). Studies have proven that flushing can improve ovulation rates and foetal implantation. In this context a study was conducted on Malabari does at ILFC, Pookode to find out the effect of flushing on conception rate, kidding rate and twinning rate.

MATERIALS AND METHODS

The study was carried out at the Goat farm, Instructional Livestock Farm Complex, College of Veterinary and Animal Sciences, Pookode, Wayanad. This is situated at latitude 11° 32' 18.5 (North) and longitude 76° 01' 14.15 (East), at an altitude of 867 m above the mean sea level. The location of study is endowed with humid climate with maximum rain fall by south west monsoon from June to September and north east monsoon from October to November.

A total of 20 Malabari does (2-3 years of age) were randomly divided into two groups of 10 each *i.e.* T₁ and T₂. The does of the two groups were on natural grazing (Congo signal grass) from 8.00 AM to 11.00 AM and were sheltered during the rest of the time in raised animal sheds. Both the groups were provided with potable water and *ad-libitum* Jack fruit leaves. The T₂ does were flushed with concentrate feed containing 18% DCP and 70% TDN (Ranjhan, S. K., 1998) at the rate of 250g per animal for two weeks prior to breeding. The ingredient composition of flushing ration is presented in Table 1 and the chemical composition assessed by proximate analysis, is depicted in Table 2. Ultrasonographic technique was used for pregnancy diagnosis in does. Animals after breeding were observed for specific signs of pregnancy from 25 days onwards at weekly intervals until kidding, at weekly intervals. The pregnancy, twinning and kidding data were recorded in a format prepared for this purpose.

Statistical Analysis

The data collected were analyzed adopting completely randomized design using the software package SPSS 10®. Significant differences between the means were evaluated using Duncan's multiple range test (DMRT) (DUNCAN 1955).

RESULTS AND DISCUSSION

Conception rate

The conception rate of T₂ does, in which the flushing was carried out was 80% and in the control group T₁ it was only 60%. The conception rate increased 20% by flushing. This must be due to the increased fertility of ovum attained by positive nitrogen balance and better supply of minerals and vitamins due to flushing. This findings are in agreement



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with Rodriguez *et al.*, (2009), Mc William *et al.*, (2004) and Boland *et al.*, (2000) who observed that feed supplementation before mating increases prolificacy and pregnancy rate in pigs, cattle, sheep and goats.

Kidding rate

The effect of flushing on kidding rate is depicted in Fig: 2. The kidding rate was higher (66.6%) in flushing group than in control group (46.6%). From the above findings it is concluded that flushing increase kidding rate which supports the observations of AceroCamelo *et al.*, (2008) who found that number of kids born in flushed goat was significantly higher.

Twinning rate

The twinning rate among flushed does was higher (90%) than in non-flushed does (80%) indicating that flushing has influence on fecundity of goats. The results are similar to Gunn *et al.*, (1992) who observed that increase in litter size was related to an increased ME intake which affect the ovulation rate directly resulting in more twinning.

CONCLUSION

From the present study it can be concluded that the flushing had significant impact on the reproductive performance of Malabari does. The does supplemented with flushing ration two weeks prior to breeding performed well than other group, non-supplemented group managed under natural grazing condition resulting in higher rates of pregnancy, kidding and twinning.

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Table.1 Ingredient composition of flushing ration

Ingredients	Percentage
Groundnut cake	35
Coconut cake	10
Rice bran	25
Yellow Maize	27
Mineral mixture	2
Salt	1

Table.2 Chemical composition of flushing Ration

Moisture (%)	9.60
Crude Protein (%)	22
Ether Extract (%)	5.20
Crude Fiber (%)	5.05
Ash (%)	6.89
Nitrogen free extract (%)	53.51
Digestible energy (in Kcal/kg DM)	2951.00

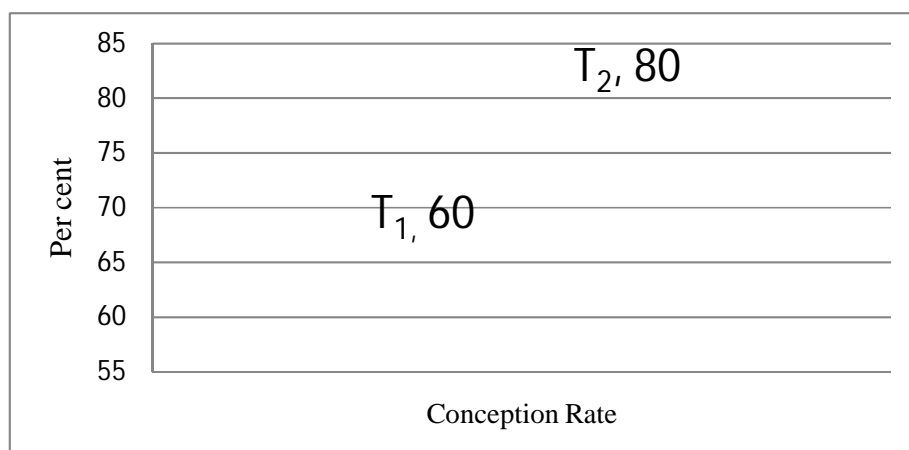


Fig. 1 Effect of flushing on conception rate (per cent)





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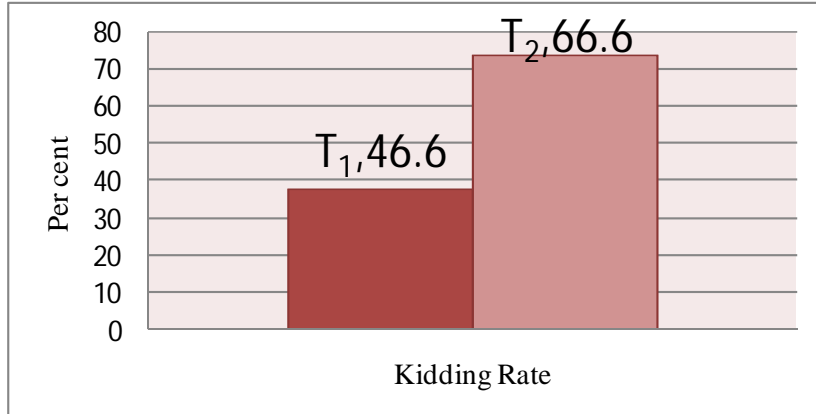


Fig.2 Effect of flushing on kidding rate (per cent)

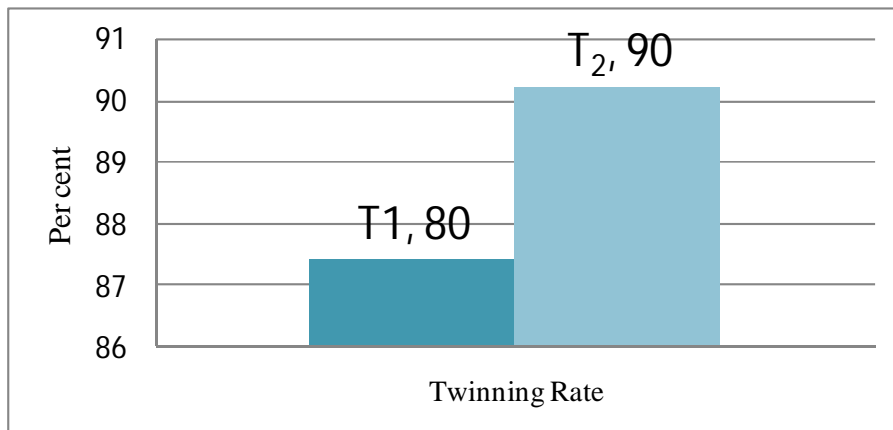


Fig.3 Effect of flushing on twinning rate (per cent)

